ROHDE&SCHWARZ
Test and Measurement
Division

Software Manual

Software for Phase Noise Measurement for FSE

with FSE-B15 or external PC with WINDOWS

FSE-K4

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1 Installation Instructions

The following paragraphs describe how to install the software, and how to remove it. For a step by step introduction to using the product please see the section entitled "How to use FSE-K4" in this manual, or on-line help.

Hardware Setup

Spectrum Analyzer

FSE-K4 is designed to work with firmware version 1.67 or better. If your Spectrum Analyzer is fitted with an earlier version, please ask your Rohde & Schwarz representative to arrange for an upgrade.

If you want to run FSE-K4 on your Spectrum Analyzer, you must have the FSE-B15 Computer Option fitted. If you do not already have this option, please ask your Rohde & Schwarz representative for details.

PC Compatible

To control your FSE Spectrum Analyzer from a PC using FSE-K4, you must first install a GPIB interface card in your computer, and then connect the PC and Spectrum Analyzer using a GPIB Cable. FSE-K4 supports the following cards:

Supplier	Model
Rohde & Schwarz	PS-B4 model 04
National Instruments	PCII, PCIIA
National Instruments	AT-GPIB/TNT (PnP), AT-GPIB/TNT
National Instruments	PCMCIA-GPIB

Rohde & Schwarz can not guarantee or provide support for FSE-K4 when used with any other manufacturer's GPIB interface products.

Before running FSE-K4 please use the setup and self-test software, supplied with the card, to ensure that all driver settings are set to their default 'factory' condition, and that the board is functioning correctly. Please consult the documentation supplied with the card to learn how to do this.

Software Setup

Spectrum Analyzer, FSE-B15 Computer Option

To install FSE-K4 on the FSE-B15 Computer Option, proceed as follows:

1. First connect the keyboard and mouse, and turn on the FSE.
2. Wait until the FSE has initialized
3. Press the ALT and Print Screen/Sys Rq keys together. The FSE display will switch to computer mode, showing the DOS prompt "C:\>".
4. Now follow the instructions, for the appropriate operating system, below.

Note: *You can switch the display back to Spectrum Analyzer mode, by pressing ALT + Print Screen again.*

PC Compatible

FSE-K4 is designed to work with Windows 3.1, 3.11, 95, 98, and NT 4. Please make sure that one of these operating systems is installed before continuing.

To install FSE-K4, simply follow the instructions, for the appropriate operating system, below.

Windows 3.1/3.11

To install FSE-K4, proceed as follows:

1. Start Microsoft Windows.

   It is strongly recommended that you exit all Windows programs that may be running now. This includes anti-virus software, office suite toolbars, information management software, etc. If you want to check the Setup disks for viruses, do it now and then exit the anti-virus software.
2. Insert the installation disk in drive A.
3. From the File menu, choose Run.
4. Type a:\setup and press ENTER.
5. A message box will appear announcing that, "FSE-K4 Setup is preparing the InstallShield® Wizard which will guide you through the rest of the setup process."
6. The Welcome screen will then appear, reminding you once again to exit all Windows programs in case they interfere with the Setup process. If necessary choose the Cancel button, exit any Windows programs, and go back to step 2. Otherwise, choose the Next button to continue.
7. Setup will then ask where you want to install FSE-K4. It will suggest a default location, "C:\R&S\FSE-K4", but you may change this if required by choosing the Browse button and selecting a new destination. Choose the Next button to continue.
8. Setup will then copy files from the Setup Disks to your hard disk.
9. Files are copied into the Windows System directory as well as the destination you selected for FSE-K4. Some of these files may already be present on your hard drive, in which case the Setup Disk's file is only copied if it is newer than the Hard Drive's file. During this process, three gauges will show: the progress of each file as it is copied, the progress of each disk, and how much space is available on the destination drive.
10. Once all files have been copied, a new Program Manager group, called FSE-K4, will be created containing the following icons:

FSE-K4 - runs the application

Help - displays the on-line help without running the application

Read Me - displays this chapter in the NotePad text editor

Uninstall - removes the application

11. Finally, a message box will be displayed informing you that the installation is complete. Press the Finish button to exit Setup.

Windows 95/98/NT 4

To install FSE-K4, proceed as follows:

1. Start Microsoft Windows

   It is strongly recommended that you exit all Windows programs that may be running now. This includes anti-virus software, office suite toolbars, information management software, etc. If you want to check the Setup disks for viruses, do it now and then exit the anti-virus software.

2. Insert the installation disk in drive A.
3. Click the Start button, and then click Run.
4. Type a:\setup and press ENTER.

   A message box will appear announcing that, "FSE-K4 Setup is preparing the InstallShield® Wizard which will guide you through the rest of the setup process."

5. The Welcome screen will then appear, reminding you once again to exit all Windows programs in case they interfere with the Setup process. If necessary choose the Cancel button, exit any Windows programs, and go back to step 2. Otherwise, choose the Next button to continue.
6. Setup will then ask where you want to install FSE-K4. It will suggest a default location, such as, "C:\R&S\FSE-K4", but you may change this if required by choosing the Browse button and selecting a new destination. Choose the Next button to continue.
7. Setup will then copy files from the Setup Disks to your hard disk.

   Files are copied into the Windows System directory as well as the destination you selected for FSE-K4. Some of these files may already be present on your hard drive, in which case the Setup Disk's file is only copied if it is newer than the Hard Drive's file. During this process, three gauges will show: the progress of each file as it is copied, the progress of each disk, and how much space is available on the destination drive.

   Once all files have been copied, a new Start menu folder, called FSE-K4, will be created containing the following shortcuts:

FSE-K4 - runs the application

Help - displays the on-line help without running the application

Read Me - displays this chapter in the NotePad text editor

Uninstall - removes the application

8. Finally, a message box will be displayed informing you that the installation is complete. Press the Finish button to exit Setup.

Removing the Software

If at any time you need to remove FSE-K4 from your PC or Spectrum Analyzer, FSE-B15 Computer Option, simply follow the instructions, for the appropriate operating system, below.

Windows 3.1/3.11

To remove FSE-K4, proceed as follows:

1. Start Microsoft Windows,
2. Switch *to Program Manager* and display the FSE-K4 group,
3. Double click on the *Uninstall* icon,
4. Follow the instructions presented by the UNinstallShield® Wizard.

Windows 95/98/NT 4

To remove FSE-K4, proceed as follows:

1. Start Microsoft Windows,
2. Click *Start*,
3. Point to *Programs*,
4. Point to *FSE-K4*,
5. Click *Uninstall*,
6. Follow the instructions presented by the UNinstallShield® Wizard.

2 How to Use FSE-K4

When measuring with FSE-K4 there are three basic steps to work through:

1. Creating an Analyzer Setup, i.e., defining the sweep parameters and, if required, the limit line (p13),
2. Making a Measurement, i.e., performing the sweep, analyzing and storing the results (p16),
3. Generating a Report (p18)

Creating an Analyzer Setup

A complete Analyzer Setup consists of the following components:

1. Sweep Setup — Defines how each measurement should be made such as signal frequency and level, offset start and stop frequencies, display reference level and range, and report configuration.
2. Limit Line — Defines the maximum allowed noise level for each frequency in the measurement band.

In order to make a measurement you must have a Sweep Setup, however the Limit Line is optional. You can load these components using any combination of the following methods:

1. Creating New Setup Files (p13)
2. Loading an Existing File (p15)

Once you have assembled and activated the necessary files in memory you can store the complete Analyzer Setup for later re-use, see Saving a File *(p15)*.

Creating New Setup Files

Before starting to make measurements with FSE-K4 you should build a library of setup files. Sweep Setup files are dependent on Limit Line files, so you should create them in the order shown below.

1. Creating a New Limit Line (p13)
2. Creating a New Sweep Setup (p14)

Each Sweep Setup file will also contain an embedded copy of any Limit Line file that it uses.

Note: *When measurement results are saved, copies of all the files used to make the measurement are stored in the result data file. In this way future examination of results will remain independent of any setup file modifications that occur after a measurement is made.*

Creating a New Limit Line

To create a new limit line:

1. Choose New (p21) from the file menu.
2. Select Limit Line in the New box.
3. If you want to base the new limit on an existing one, choose a file name in the Template box. To help you, the description of the selected file name is displayed in the Description box.
4. Otherwise if want to create a new limit from scratch, choose none in the Template box.
5. Choose the OK button to load the selected template and open the Limit Line (p29) editor.
6. If you have chosen to work with a template file, it will be displayed in the editor. Otherwise, the editor will be empty.

7. First, enter a name for the new limit line in the Name box. This name is used to create the file name for the limit when stored to disk. Thus it is restricted to eight characters in length and may consist only of characters which may be used in a DOS file name.
8. Now enter limit line samples into the Values table entry box.
9. To enter a new frequency in the left hand column of the table, move the highlight to the correct cell and type the new value. To specify a unit of measurement, append Hz, kHz, MHz or GHz to the value. In each case, the first letter is sufficient in either upper or lower case. To accept the new value either click on the tick button, or press the TAB key, or press the ENTER key. To reject the new value and retain the old one either click on the cross button, or press the ESCAPE key.

   Note: *The ENTER and ESCAPE only behave as described above when the insertion point appears in the value entry box to the right of the tick button. Normally, the ENTER key corresponds to the highlighted button and the ESCAPE key corresponds to the Cancel button.*

1. To enter a new level in the right hand column, simply move to the correct row, type the value in dBc/Hz and accept it. There is no need to enter the unit of measurement.
2. You must enter at least two samples in ascending order of frequency with the lowest frequency at the top of the table. The total number of samples entered is shown by the Samples field.
3. If you enter an illegal or out-of-range value, a message will be displayed in the Status Bar (p44) showing the range of acceptable values
4. If you did not load a template file, choose the Activate button to turn the limit line on.
5. Finally, choose the OK button to confirm the new limit line.

You can store the new limit line for later re-use, see Saving a File *(p15)*.

Creating a New Sweep Setup

To create a new Sweep setup:

1. Choose New (p21) from the file menu.
2. Select Analyzer Setup in the New box.
3. If you want to base the new setup on an existing one, choose a file name in the Template box. To help you, the description of the selected file name is displayed in the Description box.
4. Otherwise if you want to create a new setup from scratch, choose none in the Template box
5. Choose the OK button to load the selected template and open the Sweep Setup (p25) editor.
6. If you have chosen to work with a template file, it will be displayed in the editor. Otherwise, the editor will be pre-set to the default setup for the current Analyzer type.
7. First choose the Analyzer type and options with which the new setup will be used. This controls the range of frequencies that may be used, and the availability of FFT Filters..
8. Enter the frequency of the carrier you wish to measure in the Signal Frequency box. You can specify the unit by appending GHz, kHz, MHz or GHz. In each case, the first letter is sufficient in either upper or lower case.
9. In the Signal Level box, enter the magnitude of the carrier in dBm. This value is used to set the analyzer reference level.
10. If you do not know the precise frequency of the carrier you wish to measure, select the Verify Signal Frequency and Level box. This enables a search, within a defined frequency tolerance range relative to the specified Signal Frequency, for the carrier of greatest magnitude. The frequency and level of this carrier are then accurately measured. If the resultant level is less that the specified Signal Level less a defined Level Tolerance, the measurement is aborted. Otherwise, the resultant frequency is used in place of the specified Signal Frequency, and the measured level is used to set the analyzer reference level, overriding the value specified in the Signal Level box.
11. If enabled, enter a value in the Frequency Tolerance box. This defines the offset, either side of the specified Signal Frequency, within which the carrier is guaranteed to be. FSE-K4 will search for a carrier between Signal Frequency - Frequency Tolerance and Signal Frequency + Frequency Tolerance.

12. If enabled, enter a value in the Level Tolerance box. This defines the offset relative to the specified Signal Level above which the carrier is guaranteed to be.
13. The Minimum Offset and Maximum Offset boxes allow you to select the range of frequencies to measure. Each contains a list of positive offsets from the carrier. The Maximum Offset must be greater than the Minimum Offset, and the Signal Frequency + Maximum Offset must be less than or equal to the maximum frequency of the analyzer.
14. The Maximum Level and Level Range boxes refer to FSE-K4's Graph rather than the analyzer display. The Maximum Level is specified in dBc/Hz since the displayed data is normalized to the carrier level.
15. The trace may be offset by a fixed number of dBs entered in the Trace Offset box.
16. Optionally the trace may also be smoothed by calculating the average of samples in a sliding window, see Smoothing Window in Sweep Setup (p25) for details.
17. Choose the Report button to display the Report Setup *(p27)* dialogue box. This allows you to set initial values for various report text fields, and select which elements of the report to include. Once these values are set, choose the OK button to accept any changes
18. In special circumstances you can further optimize the measurement by modifying the parameters shown in the Advanced Sweep Setup *(p27)* dialogue box. To open this choose the Advanced button, then once new values have been set, choose the OK button to accept any changes.
19. Choose the OK button in the Sweep Setup dialogue box to confirm the new Sweep setup.

Loading an Existing File

To load an existing file from disk:

1. Choose Open (p21) from the file menu.
2. If you wish to load a file from a default directory, as defined in the Default Paths (p36) dialogue box, check the Jump to default directories box.
3. Otherwise, make sure that this box is unchecked.
4. Select the type of file you wish to load in the List Files of Type box.
5. If Jump to default directories is checked, FSE-K4 will automatically display the contents of the chosen file type's default directory and you should skip steps 4 and 5.
6. Select the drive containing the file you want to load in the Drives box.
7. Select the directory containing the file you want to load in the Directories box.
8. Type the name of the file you want to load in the File Description box or select it in the file list box below.
9. Choose the OK button to confirm your selection and load the file.
10. If loading the chosen file will affect any unsaved changes to the files in memory, FSE-K4 will ask if you want to save the changes. You will be asked this question for each modified file, and if you decide to save a modified file the Save As (p22) dialogue box will be displayed.
11. If there is measured data in memory and loading the chosen file will directly affect the way in which a measurement is made, FSE-K4 will warn you that all measured data will be discarded.

Exactly how the contents of memory gets changed depends on the type of file loaded as shown in the table below:

File of Type	Affected Memory Files
Limit Line	The selected limit line only.
Analyzer Setup	The Sweep Setup, and Limit Line are changed and any Result Data discarded.
Result Data	The Sweep Setup and Limit Line are changed and any Result Data discarded. Reference data if any, is loaded into the reference trace. Sweep Data is loaded into the main trace.

If you have loaded a limit line, the file will be activated.

Saving a File

There are two ways of saving a file to disk, namely Save and Save As. Which one you use depends on whether the file has previously been named or not.

The exact contents of the saved file depends on its type as shown in the table below:

File of Type	Contents
Limit Line	The selected limit line only.
Analyzer Setup	The current Sweep Setup and any activated Limit Line.
Result Data	The Sweep, the Reference Trace if any, the current Sweep Setup and any activated Limit Line.

Saving an Unnamed File

To save a new file to disk:

1. Choose Save As (p22) from the File menu.
2. If you wish to save a file to a default directory, as defined in the Default Paths (p36) dialogue box, check the Jump to default directories box.
3. Otherwise, make sure that this box is unchecked.
4. Select the type of file you wish to save in the List Files of Type box.
5. If Jump to default directories is checked, FSE-K4 will automatically display the contents of the chosen file type's default directory and you should skip steps 4 and 5.
6. Select the drive you want to save the file on in the drives box.
7. Select the directory you want to save the file in with the Directories box.
8. Type the name and description you want to save the file under in the File Description box or select an existing name from the file list box below.
9. If you are saving a Limit Line, the file name will be set to that specified in the limit editor and you will not be able to modify it. However, you can still enter a description.
10. Choose the OK button to confirm your selection and save the file.

Saving a Named File

To save a previously named file:

1. Choose Save (p22) from the File menu.
2. Select the type of file you wish to save in the File of Type box. To help you, the description of the file currently in memory is displayed in the Description box.
3. Choose the OK button to confirm your selection and save the file using the existing name and description.

Making a Measurement

Measuring with FSE-K4 consists of three steps:

1. Making a Sweep Measurement (p17)
2. Using the Marker menu commands for Analyzing Sweep Results (p18)
3. Storing the results for later re-use, as described in Saving a File (p15).

In cases where the phase noise of the unit under test is comparable to the inherent phase noise of the analyzer, a two stage measurement may be used to improve the accuracy of the final result.

To make a two stage measurement:

1. First connect a reference source to the analyzer.
2. Make a Sweep Measurement as described above.
3. Choose Trace to Reference *(p33)* from the Sweep menu to copy the trace into the reference buffer.
4. Now connect the unit under test.
5. Make a second Sweep Measurement.
6. Choose Corrected *(p30)* from the View menu.
7. The application will perform a linear subtraction of the reference trace from the uncorrected trace, and plot the result.

Once a two stage measurement is complete you can

- Switch back to the uncorrected trace by choosing Uncorrected *(p30)* from the View menu.
- Display the reference trace by choosing Reference *(p30)* from the View menu. The Normal and Delta marker displays will change to include calculated level offsets from the marker level to the reference trace.

To stop using the Reference Trace:

- Choose Clear Reference (p33) in the Sweep menu.

Making a Sweep Measurement

To run a Sweep:

- Choose Start (p32) from the Sweep menu.

The Analyzer will be configured according to the current Analyzer Setup. If this fails, an information dialogue will be displayed describing the problem and the measurement will be aborted.

If the Verify Frequency and Level function is selected in the Sweep Setup (p25) dialogue box, FSE-K4 will then check to see if there is a Signal within the specified Frequency and Level Tolerance ranges relative to the specified Signal Frequency and Level. If no Signal is found, or a Signal is found, which is outside the tolerance range, an information dialogue will be displayed describing the problem, and the measurement will be aborted.

After a short delay the Analyzer will start measuring and automatically uploading the Sweep results to the computer. The Status Bar (p44) message changes to read "Sweep running...(0%)", and as data is received the value inside the parentheses is updated to show the ratio of samples received to the total expected, expressed as a percentage.

The overall sweep is divided into a number of sub-bands, which are measured separately. This is optimized to provide the best combination of measurement accuracy and speed.

If the Graph is visible, data will be plotted as soon as it is received. In many cases, the Sweep will generate more samples than can be displayed. A data reduction algorithm is used to ensure that the level represented by each pixel column in the displayed trace represents the maximum value measured for the band of frequencies it represents. This data reduction process does not affect the raw data uploaded from the Analyzer; which may be viewed, once the sweep is complete, by zooming in until every pixel column represents a single raw data sample. FSE-K4 can store up to 20,000 samples in memory.

If the RF Overload warning is activated whilst measuring a sub-band, the input attenuation will be increased by 10dB and the sub-band will be re-measured.

If the sweep cannot be completed for any reason, an information dialogue will be displayed describing the problem and the measurement will be aborted.

Whilst the sweep is in progress you can:

1. Use the Normal (p34) and Delta (p34) Markers. These may be turned on using the commands in the Marker menu and moved along the trace using either the keyboard cursor keys, or by positioning the mouse pointer and then clicking the left mouse button.
2. Abort the sweep by choosing Stop (p32) from the Sweep menu. An information dialogue will be displayed confirming this action and the measurement will be aborted.

Analyzing Sweep Results

The Marker menu provides a number of tools to help you examine the phase noise trace.

1. The Normal *(p34)* marker displays the phase noise level measured at a specific frequency.
2. The Delta *(p34)* marker displays the offset frequency and level relative to the Normal marker.
3. When the Delta marker is enabled, Next Marker *(p34)* allows you to select which marker's frequency may be varied using the mouse and/or cursor keys.
4. Use the Measure at Marker *(p34)* command in the Marker menu to re-measure phase noise at the current marker frequency.
5. The Zoom function allows you to view the Sweep results in greater detail, ultimately removing the effects of data compression so that the raw data is displayed.

   If the marker is in Normal mode, the Zoom In *(p34)* command will redraw the Graph, changing the frequency span to show one tenth of the previous span, centered on the marker frequency. Zoom In may be used repeatedly until only raw data is displayed, with no data reduction. Zoom Out *(p35)* has the opposite effect, increasing the span by a factor of ten centered on the marker, whilst Original Diagram *(p35)* returns the display to the span defined by the Sweep Setup.

   When the marker is in Delta mode, Zoom In changes the span to show frequencies between the reference and delta markers.

In addition, the View menu provides two extra commands for displaying calculated values for Residual Phase Modulation and Residual Frequency Modulation respectively. When the Delta marker is enabled, the calculation is performed on the measured values lying between the two markers. Otherwise, all measured values are taken into account.

Generating a Report

There a three steps to consider when generating a measurement report:

1. Setting up the Printer (p19)
2. Previewing a Report (p19)
3. Printing a Report (p19)

You can store the Result Data for later re-use, see Saving a File *(p15)*.

Setting up the Printer

To setup the printer:

1. Choose Print Setup (p24) from the File menu.
2. Select the output device you want to use in the Printer box.
3. In the orientation box, select Portrait.
4. FSE-K4 is designed to print reports in portrait mode. Use of other formats may lead to unpredictable results.
5. If you are using an HP Laser Jet type printer, choose the Options button to display the Options dialogue box. Select Line Art in the Dithering box then choose the OK button to accept the changes. Finally choose the OK button in Print Setup to accept the changes.

Note: *Some drivers such as the HP Plotter cannot be selected from FSE-K4. In this case you should use the Printer Setup command in Print Manager's Options menu.*

Previewing a Report

To preview a report before printing:

1. Choose Print Preview (p23) from the File menu.
2. The Print Preview window will appear showing how a report would appear with the current report setup and measurement results.
3. To view the following page, choose the Next button.
4. Choose the Previous button to go back one page.
5. To change the report setup choose the Setup button.
6. The Preview Setup (p23) dialogue will be displayed allowing you to customize the report for the current unit under test. For example, you may enter the Make, Model, and Serial Number. When you save your measurement results, these changes will be saved in the Result Data file. However, they will not affect the Sweep Setup, so when you start a new Sweep measurement, any changes made here will be lost. If you want to make permanent changes, use the Sweep Setup editor and then save the Analyzer Setup.
7. Choose Print to send the report to a printer.
8. Choose the Close button to exit the Print Preview window.

Printing a Report

To print a report without using Print Preview :

- Choose Print (p24) from the File menu.

  The "Printing in progress" message box will appear containing a small picture of a printer, a page counter, and a Cancel button. As the print job progresses, sheets of paper will appear to feed through the printer and the counter will increment.

  If Print Manager is enabled, FSE-K4 will print the Test Report immediately and Print Manager will handle any problems with the printer.

  Otherwise, the speed of report generation will be governed by the printer and Windows will handle any problems directly.

  Choosing the Cancel button will abort the report generation process, however you may have to clear the Print Manager or printer buffer.

3 Menu Commands

This chapter describes all menu commands and their dialogue boxes. The menus are arranged as in the menu bar *(p43).*

File Menu

The File menu comprises the commands used for creating, opening, saving, printing files and for exiting FSE-K4.

New command (File Menu)

Use this command to create new Analyzer Setups, and Limit Lines, or to load an existing Analyzer Setup prior to making a new measurement. In each case you can select a template file on which to base the new file or measurement. You can open an existing file with the Open *(p21)* command.

Dialogue Box Options

New

Select the type of new file you want to create.

Measurement	Loads a Analyzer Setup and prepares for a new Sweep.
Analyzer Setup	Loads a template file and opens the Analyzer Setup editor.
Limit Line	Loads a template file and opens the Limit Line editor.

Use Template

Select the name of the template file you want to use for the new file or measurement. FSE-K4 lists template files, which are stored at the locations defined in the Default Paths *(p36)* dialogue box, and stored in your FSE-K4.INI file. If you select *none* as the template for a new Limit file, the editor will be empty. On selecting *none* for a new Analyzer Setup, the editor will be filled with the default settings for the Analyzer.

Description

Whenever a file is saved, a long description may be entered at the right hand side of the File Description box in the Save As dialogue box. This information is read from the template file you select in the Use Template box and displayed in the Description box.

Open command (File Menu)

Use this command to open an existing Analyzer Setup, Limit Line, or Result Data file. You can create new files with the New *(p21)* command.

Dialogue Box Options

File Description

Type or select the filename you want to open. This box lists file names and descriptions of the files with the extension you select in the List Files of Type box.

List Files of Type

Select the type of file you want to open.

Analyzer Setup (*.set)	Lists all the files saved with the .SET extension.
Result Data	Lists all the files

(*.dat)	saved with the .DAT extension.
Limit Line	Lists all the files
(*.lim)	saved with the .LIM extension.

Note: *See Jump to default directories below.*

Drives

Select the drive on which FSE-K4 stores the file that you want to open.

Directories

Select the directory in which FSE-K4 stores the file you want to open.

Jump to default directories

Enables automatic setting of the default drive and path each time you change to a different file type using the List Files of Type box.

Save command (File Menu)

Use this command to save an active file with its current name and description. When you save a new file for the first time, FSE-K4 displays the Save As dialogue box so you can name the file. If you want to change the name or description of an existing file before you save it, choose the Save As *(p22)* command.

Dialogue Box Options

File of Type

Select the type of file you want to save.

Analyzer Setup	Saves the current Analyzer Setup file.
Result Data	Saves the current Result Data file.
Limit Line	Saves the current Limit Line file.

Description

Whenever a file is saved, a long description may be entered at the right hand side of the File Description box in the Save As dialogue box. This information for current file, of the type you select in the File of Type box, is displayed in the Description box.

Save As command (File Menu)

Use this command to save, name and describe the active file of a specified data type.

Note: *To save a file with its existing name and description, use the Save* (p22) *command.*

Dialogue Box Options

File Description

Type a new filename in the left hand box to save a file with a different name.
Use the current name, or select a name in the list to save a file with an existing filename.
A filename can contain up to eight characters and an extension of up to three characters. FSE-K4 adds the extension for the data type you specify in the List Files of Type box. Filenames for Limit files must be defined using the corresponding editor and cannot be modified by the Save As dialogue box.
Type a new file description or modify an existing one in the right hand side of the box.

List Files of Type

Select the type of file you want to open.

Analyzer Setup	Lists all the files

(*.set)	saved with the .SET extension.
Result Data	Lists all the files
(*.dat)	saved with the .DAT extension.
Limit Line	Lists all the files
(*.lim)	saved with the .LIM extension.

Note: *See Jump to default directories below.*

Drives

Select the drive on which FSE-K4 will store the file that you want to save.

Directories

Select the directory in which FSE-K4 will store the file you want to save.

Jump to default directories

Enables automatic setting of the default drive and path each time you change to a different file type using the List Files of Type box.

Print Preview command (File Menu)

Use this command to display the print preview window, with which you can see how a report will look when you print it. FSE-K4 displays each page in a reduced size. You can customize the report for the current unit under test, see Preview Setup *(p23)* dialogue box for more information.

To preview a report before printing

1. From the File menu, choose Print Preview (ALT, F, V).
2. FSE-K4 displays the first page of the report.
3. To customize the report for the current unit under test, choose the Setup (ALT, S) button.
4. To view different pages in the report, use the Previous (ALT, P) and Next (ALT, N) buttons.
5. To print the report use the Print (ALT, R) button.
6. After viewing the report in print preview, you can close the print preview window by choosing the Close (ALT, C) button or pressing the ESCAPE key.

Preview Setup command (File Menu)

Use this dialogue to customize the report text and configuration for the current Unit Under Test.

Dialogue Box Options

Heading, ..., Comment 2

Type report text as required.

Titles

Includes the above text fields in the report. If the result data has been stored to a disk file, the file name and description will also be included.

Setup

Includes the Sweep Setup information in the report.

Date

Includes the time and date at which the last measurement was made in the report.

Markers

Includes the Normal and Delta Markers, if they are turned on in the main display.

Print command (File Menu)

Use this command to print reports. To specify a printer and its connection, use the Print Setup *(p24)* command in the File menu. Alternatively you can use the Printer Setup command in the Options menu of Print Manager. See your Windows documentation for more information.

Print Setup command (File menu)

Use this command to select a printer and connection, and specify printer settings. The settings you select become the default settings.

Dialogue Box Options

Printer

Select the printer you want to use.

Default Printer Uses the current default system printer.

Specific Printer Uses a printer selected from the list of installed devices.

Note: *You install printers and configure ports through the Windows Control Panel. For information on installing printers, see your system documentation.*

Orientation

Select the page orientation, Portrait or Landscape, that you want for printing.
With Portrait, the page is taller than it is wide when you view the printed document upright (the document prints lengthways on the page). With Landscape, the page is wider than it is tall when you view the printed document upright (the document prints sidewise on the page).

Paper

Select the size and source of paper you want to use.

Size Open the list and then select the size of paper you want to use.

Source Open the list, and then select the paper source you want to use.

Options

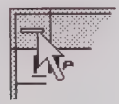
Choose this button to display the Options dialogue box, which contains additional options specific to the printer you select in the Printer box.
For more information, open the Options dialogue and select the Help command button.

Exit command (File Menu)

Use this command to end your FSE-K4 session. You can also use the Close command on the application Control menu. FSE-K4 prompts you to save files with unsaved changes.

Shortcuts

Mouse: Double-click the application Control-menu button.



Keys: ALT+F4

Edit Menu

The Edit menu comprises the commands used for defining the analyzer setup parameters (sweep parameters) and the limit lines. The purpose of these settings is outlined in section „Creating an Analyzer Setup“ on page 13.

Sweep Setup command (Edit Menu)

Use this command to modify Analyzer Setup parameters.

Note: *Changes that affect the validity of displayed results will cause the measurement buffers to be cleared. In this case a warning message will be displayed when the OK button is chosen.*

Dialogue Box Options

Analyzer

Model

Select the type of Analyzer that this setup will be used with. This determines the range of frequencies that are available.

FSE-B2

Select this box if the setup will be used with an Analyzer equipped with the FSE-B2 7GHz Frequency Extension option. This box is only enabled for the following Analyzer models: FSEA 20, FSEA 30 and FSIQ 3.

FSE-B4

Select this box if the setup will be used with an Analyzer equipped with the FSE-B4 Low Phase Noise and OCXO option. This box is only enabled for the following Analyzer models: FSEA 20, FSEB 20, FSEM 20, and FSEK 20.

FSE-B5

Select this box if the setup will be used with an Analyzer equipped with the FSE-B5 FFT Bandwidths option. This box is only enabled for the following Analyzer models: FSEA 20, FSEB 20, FSEM 20, and FSEK 20.

Signal

Frequency

Enter the frequency of the carrier whose phase noise you wish to measure.
Specify the unit by appending GHz, kHz, MHz or GHz. In each case, the first letter is sufficient in either upper or lower case.

Level

Magnitude of carrier in dBm.

Verify Frequency

Enables a search, across a frequency tolerance range, for the carrier of greatest magnitude. Resultant carrier frequency and level are measured. If the level is within a level tolerance range, the measured values override the specified Signal Frequency and Level. Otherwise the measurement is aborted.
This should be used when carrier frequency is not known precisely and when a very small Minimum Offset is used.

Frequency Tolerance

Range, either side of Signal Frequency, within which the carrier is known to be. Specify unit as for Frequency.

Level Tolerance

Offset relative to Signal Level above which the carrier is know to be.

Display

X-Axis

Minimum Offset

Select the offset at which to start the sweep.

Maximum Offset

Select the offset at which to finish the sweep.

Y-Axis

Maximum Level

Enter the value you want at the upper extent of the Graph's level axis. Phase Noise levels are normalized to the carrier level and expressed in dBc/Hz.

Level Range

Enter the range of values you want for the Graph's level axis in dB.

Tools

Trace Offset

Enter any fixed offset in dB. This value will be added to each measured value.

Smoothing Window

The trace may be smoothed by calculating the linear average of sample values in a sliding window. Enter the width of the window as a number of samples.
The width must be a positive, odd, integer, less than 200, i.e. $0 < n < 200$, n mod 2 = 1. The default value of 1 turns smoothing off.
The smoothing algorithm used is as follows:

$$y'(s) = 10 * Log_{10}\left(\left(\sum_{x=s-\left(\frac{n-1}{2}\right)}^{x=s+\left(\frac{n-1}{2}\right)} 10^{\left(\frac{y(x)}{10}\right)}\right) \div n\right)$$

Where: s = the trace sample number, $y(s)$ = the phase noise at sample s, x = the sample offset from s, and n = the width of the sliding window. When x exceeds the boundary samples, the boundary sample is used, i.e. if the trace has samples numbering 0 to 500 then with n = 5 and s = 0 the average is calculated as:

$$y'(0) = 10 * Log_{10}\left(\left(3 * 10^{\left(\frac{y(0)}{10}\right)} + 10^{\left(\frac{y(1)}{10}\right)} + 10^{\left(\frac{y(2)}{10}\right)}\right) \div 5\right)$$

Report

Opens the Report Setup *(p27)* dialogue box.

Advanced

Opens the Advanced Sweep Setup *(p27)* dialogue box.

Report Setup

Use this dialogue to define those parts of the report text which are independent of the Unit Under Test and to select the default report configuration.

Dialogue Box Options

Heading, ..., Comment 2

Type report text as required.

Titles

Includes the above text fields in the report. If the result data has been stored to a disk file, the file name and description will also be included.

Setup

Includes the Sweep Setup information in the report.

Date

Includes the time and date at which the last measurement was made in the report.

Markers

Includes the Normal and Delta Markers, if they are turned on in the main display.

Advanced Sweep Setup

FSE-K4 measures each decade of offset from the carrier in a separate sweep. Some decades are further split into sub-bands to allow optimum use of resolution filter and main PLL bandwidths. Use this dialogue to modify the Resolution Filter Bandwidths for each sub-band. In addition you can set the number of averaging sweeps made for each sub-band, and for analyzers equipped with FFT filters you can choose between FFT or normal filters for each sub-band.

Dialogue Box Options

Settings

See Using Table Entry Boxes *(p51)* for detailed information about using this control.

From

This column lists the start frequency of each sub-band

To

This column lists the stop frequency of each sub-band

Resolution BW

This column lists the Resolution Filter Bandwidth used for each sub-band. Enter values between 1 Hz and 3 MHz in steps of 1, 2, 3 and 5. You can specify the unit by appending GHz, kHz, MHz or GHz. In each case, the first letter is sufficient in either upper or lower case.

Sweep Count

This column lists the number of sweeps to average over for each sub-band. Values must be integer, greater than zero, and odd. Default is 1.

Use FFT Filter

This column only appears when FSE-K4 detects an analyzer supporting FFT filters, or when there is no analyzer attached to your PC. It allows you to choose whether to use the FFT Resolution Filter or the conventional filter for each decade.

When you enable FFT Filters for the decades starting at 10 Hz and 100 Hz, the entire decade is measured in one sweep. Accordingly the three sub bands used with normal filters are replaced with a single sub band. The Resolution Filter Bandwidth used is fixed for each sub-band, and cannot be modified.

Default

Select this button to return all settings to the following default values:

FSEx 20

From	To	Resolution BW	Sweep Count	Use FFT Filter
10 Hz	20 Hz	2 Hz	1	Off
20 Hz	40 Hz	5 Hz	1	Off
40 Hz	100 Hz	10 Hz	1	Off
100 Hz	200 Hz	20 Hz	1	Off
200 Hz	400 Hz	50 Hz	1	Off
400 Hz	1 kHz	100 Hz	1	Off
1 kHz	10 kHz	200 Hz	1	Off
10 kHz	30 kHz	500 Hz	1	Off
30 kHz	100 kHz	3 kHz	1	Off
100 kHz	1 MHz	3 kHz	1	Off
1 MHz	10 MHz	30 kHz	1	not available
10 MHz	100 MHz	300 kHz	1	not available
100 MHz	1 GHz	3 MHz	1	not available
1 GHz	10 GHz	3 MHz	1	not available

FSEx 30

From	To	Resolution BW	Sweep Count	Use FFT Filter
10 Hz	20 Hz	2 Hz	1	Off
20 Hz	40 Hz	5 Hz	1	Off
40 Hz	100 Hz	10 Hz	1	Off
100 Hz	200 Hz	20 Hz	1	Off
200 Hz	400 Hz	50 Hz	1	Off
400 Hz	1 kHz	100 Hz	1	Off
1 kHz	10 kHz	200 Hz	1	Off
10 kHz	60 kHz	500 Hz	1	Off
60 kHz	100 kHz	500 Hz	1	Off
100 kHz	200 kHz	3 kHz	1	Off
200 kHz	1 MHz	3 kHz	1	Off
1 MHz	10 MHz	30 kHz	1	not available
10 MHz	100 MHz	300 kHz	1	not available
100 MHz	1 GHz	3 MHz	1	not available
1 GHz	10 GHz	3 MHz	1	not available

RBW/VBW Ratio

Select the ratio of Resolution Filter Bandwidth to Video Filter bandwidth. The default value is 10-to-1, but you can also select 1-to-1, or 1-to-10 in special circumstances.

Limit Line command (Edit Menu)

Use this command to create and modify and activate Limit Line files.

Dialogue Box Options

Name

Type a name for the limit line.
This name will be used to identify the limit line when plotted on the Graph and when it is stored on disk or downloaded to a Analyzer. It may be up to eight characters long and can use any combination of the following: A..Z a..z 0..9 and _.

Values

Use this box to enter the limit line definition. This box has two columns for sample frequency and level respectively. Frequencies must be entered in order of magnitude with the lowest value at the top of the list. You can specify the unit by appending Hz, kHz, MHz or GHz. In each case, the first letter is sufficient in either upper or lower case. Limit values are assumed to be in dBc/ Hz, so it is not necessary to specify a unit.
You must enter at least two samples in ascending order of frequency with the lowest frequency at the top of the table. The total number of samples entered is shown by the Samples field. If you enter an illegal or out-of-range value, a message will be displayed in the Status Bar *(p44)* showing the range of acceptable values

See Using Table Entry Boxes *(p51)* for more information.

Activate/Deactivate

Changes the status of the limit line to active or not active. When active the limit line will appear on the Graph panel.

Shift Level

Opens the Shift Level *(p29)* dialogue box.

Insert

Inserts a new row in the Values box at the highlighted position.

Delete

Removes the highlighted row in the Values box.

Samples

Displays the number of samples that have been defined.

Maximum

Displays the maximum number of samples that can be defined. This value is always 50.

Shift Level

Use this dialogue to alter the level of all samples in the limit line by an amount that you specify.

Dialogue Box Options

Level Offset

Type the offset value you want to use.

View Menu

The View menu comprises the commands used for customizing the screen by displaying or hiding various information panels, traces and measurement results.

Graph command (View Menu)

This command only appears when a check mark appears next to the Measurement Log *(p36)* command in the Options menu.
Use this command to display or hide the Graph and Markers panels.
A check mark appears next to the command name when the Graph is displayed.
For more information, see Graph *(p45)*.

Log command (View Menu)

This command only appears when a check mark appears next to the Measurement Log *(p36)* command in the Options menu.
Use this command to display or hide the Log panel, which lists information about the progress of each measurement as well as reporting key values used or measured.
A check mark appears next to the command name when the Log is displayed.
For more information, see Log *(p45)*.

Uncorrected command (View Menu)

This command is only enabled when the reference trace buffer is not empty. A measurement trace may be copied into the reference buffer using the Trace to Reference *(p33)* command in the Sweep menu.
Use this command to display the Uncorrected trace on the Graph panel. A check mark appears next to the command name when the Uncorrected trace is displayed. This command also hides the Corrected trace.
When this command is checked the Uncorrected trace will also appear in the Report Diagram.

Reference command (View Menu)

This command is only enabled when the reference trace buffer is not empty. A measurement trace may be copied into the reference buffer using the Trace to Reference *(p33)* command in the Sweep menu.
Use this command to display or hide the Reference trace on the Graph panel. A check mark appears next to the command name when the Reference trace is displayed.
When this command is checked the reference trace will also appear in the Report Diagram.

Corrected command (View Menu)

This command is only enabled when the reference trace buffer is not empty. A measurement trace may be copied into the reference buffer using the Trace to Reference *(p33)* command in the Sweep menu.
Use this command to display the Corrected trace on the Graph panel. A check mark appears next to the command name when the Corrected trace is displayed. This command also hides the Uncorrected trace.
When this command is checked the Corrected trace will also appear in the Report Diagram.

Residual PM command (View Menu)

Use this command to display or hide the calculated Residual Phase Modulation on the Graph panel. A check mark appears next to the command name when the Residual PM is displayed.
In Normal Marker mode, or with no markers displayed, Residual Phase Modulation is calculated using all measured values from the Minimum Offset to the Maximum Offset inclusive. In Delta Marker mode, the calculation is based on the measured samples that lie between the two markers, and is updated each time the frequency of either marker changes.
When this command is checked the Residual PM value will also appear in the Report Diagram.

Residual FM command (View Menu)

Use this command to display or hide the calculated Residual Frequency Modulation on the Graph panel. A check mark appears next to the command name when the Residual FM is displayed.
In Normal Marker mode, or with no markers displayed, Residual Frequency Modulation is calculated using all measured values from the Minimum Offset to the Maximum Offset inclusive. In Delta Marker mode, the calculation is based on the measured samples that lie between the two markers, and is updated each time the frequency of either marker changes.
When this command is checked the Residual FM value will also appear in the Report Diagram.

Sweep Menu

The Sweep menu comprises the commands used for starting and terminating a measurement and for storing and deleting the reference trace.

Start command (Sweep Menu)

Use this command to begin a new Sweep measurement using the current Analyzer Setup file.

***Note:** Any displayed Sweep results will be cleared by this command.*

FSE-K4 starts by configuring the analyzer according to the current Analyzer Setup. If for any reason the Analyzer does not respond, an error message will be displayed describing the problem. See Communication Problems *(p55)* for more information.
If the Verify Frequency and Level function is selected in the Sweep Setup *(p25)* dialogue box, FSE-K4 will then check to see if there is a Signal within the specified Frequency and Level Tolerance ranges relative to the specified Signal Frequency and Level. If no Signal is found, or a Signal is found, which is outside the tolerance range, an information dialogue will be displayed describing the problem, and the measurement will be aborted.
As soon as the Sweep starts, "Sweep running... (0%)" will appear in the Status Bar. The percentage indicator will increase each time a new block of data is displayed and is calculated as the ratio of values received to total values expected.
The overall sweep is divided into a number of sub-bands, which are measured separately. This is optimized to provide the best combination of measurement accuracy and speed. If the RF Overload warning is activated whilst measuring a sub-band, the input attenuation will be increased by 10dB and the sub-band will be re-measured. If the sweep cannot be completed for any reason, an information dialogue will be displayed describing the problem and the measurement will be aborted.
Once the Sweep is finish, "Sweep complete" appears in the Status Bar.

Stop command (Sweep Menu)

Use this command to terminate a Sweep measurement.
"Sweep aborted" will appear in the Status bar *(p44)*, an information dialogue will be displayed confirming the action, and FSE-K4 will stop the Sweep.

Mode command (Sweep Menu)

Use this command to switch repetitive Sweeping on and off and also to choose between Graph *(p45)* display modes Clear/Write and Max. Hold.
A sub-menu appears when this command is selected with the following options:

Clear/Write

Use this command to disable repetitive Sweeping and select Clear/Write display mode.
The Sweep will then end at the stop frequency of the Sweep.
A check mark appears next to the command name when this mode is selected.

Repeat Clear/Write

Use this command to enable repetitive Sweeping in the Clear/Write display mode.
The Sweep will then automatically re-start each time the Analyzer reaches the stop frequency of the Sweep. In Clear/Write mode, the Graph panel displays only those values measured during the current pass.
A check mark appears next to the command name when this mode is selected.

Repeat Max. Hold

Use this command to enable repetitive Sweeping in the Max. Hold display mode.

The Sweep will then automatically re-start each time the Analyzer reaches the stop frequency of the Sweep. In Max. Hold mode, the Graph displays the maximum value measured at each frequency during all passes since the Repeat Max. Hold command was used.

A check mark appears next to the command name when this mode is selected.

Trace to Reference command (Sweep Menu)

Use this command to copy the main Sweep trace into the Reference Trace Buffer.
You can then make a new measurement or load an existing Result Data file and compare the traces in the following ways:

- use the Reference *(p30)* command in the View menu to display the reference with the main trace then,
- use the Graph *(p45)* panel to compare them visually or
- use the Markers *(p46)* to compare them point by point or
- use the Corrected *(p30)* command in the View menu to display the calculated difference between the main and reference traces.

Note: *Both traces must be measured using the same Analyzer setup. The reference trace will be cleared as soon as an incompatible setup is loaded.*

Reference trace data may be stored along with other measurement results by using the Save *(p22)* command with the File of Type box set to Result Data.

Clear Reference command (Sweep Menu)

Use this command to clear the contents of the Reference Trace Buffer.

Marker Menu

The Marker menu comprises the commands used for handling the marker functions and for magnifying a selected portion of the measured spectrum.

Normal command (Marker Menu)

Use this command to display or hide the Normal marker and the Markers box, which shows the current frequency and level co-ordinates of the Graph marker(s).
A check mark appears next to the command name when the Normal marker and Marker box are displayed.
For more information, see Markers *(p46)* and Moving the marker *(p50)*.

Delta command (Marker Menu)

Use this command to switch between normal and delta marker modes.
In delta mode, the Delta marker will initially appear superimposed on the Normal marker. All keyboard and mouse methods for marker positioning will apply to the Delta marker, whilst the Normal marker will remain fixed in position, see Moving the marker *(p50)* for details.
A check mark appears next to the command when the delta marker mode is selected.
For more information, see Markers *(p46)*.

Next Marker command (Marker Menu)

This command is only enabled when the delta marker is active.
Use this command to toggle control of marker frequency between the Normal and Delta markers.

Measure at Marker command (Marker Menu))

Use this command to measure phase noise using the analyzer's Phase Noise Marker at the current marker frequency.
If the marker frequency is not between the analyzer's current start and stop frequencies, the sub-band containing it will be swept first using the current Analyzer Setup parameters.
This command provides a convenient method for checking Phase Noise at spot frequencies.

Note: *This command is disabled whilst a Sweep measurement is running.*

Zoom In command (Marker Menu))

Use this command to magnify a selected portion of the measured spectrum displayed by the Graph *(p45)*.
This may be used when more values have been measured than can be represented on the horizontal axis due to insufficient display resolution. The frequency axis of the Graph is expanded and all traces and the limit lines are redrawn. The level axis is not affected.
You can use the Zoom In command repeatedly until all detail is visible at which point the command is disabled.
The frequency range covered by the zoom function depends on the marker mode:

Normal (p34)	The frequency axis is expanded to show 10% of the display width centered on the current marker frequency. In the vicinity of the start and stop frequencies the software performs an adaptation.
Delta (p34)	The frequency axis is expanded to show the band between the normal and delta markers

Zoom Out command (Marker Menu)

Use this command to undo the last Zoom In *(p34)* command.

The new display will be centered on the Normal Marker frequency. In the vicinity of the start and stop frequencies the software performs an adaptation.
You can use the Zoom Out command repeatedly until all Zoom commands have been undone and the complete measurement spectrum is displayed. If you want to undo the all Zoom commands in one go, choose the Original Diagram *(p35)* command.

Note: *This command is only available when the Delta* (p34) *marker is disabled.*

Original Diagram command (Marker Menu)

Use this command to undo all Zoom commands and display the complete measurement spectrum.
This command is automatically performed whenever the Start *(p32)* command is used to make a new Sweep measurement.
If you want to undo the last Zoom In command, choose the Zoom Out *(p35)* command.

Options Menu

The Options menu offers various settings specifying the Measurement Log function, the components of the display, the default paths for data files and the analyzer. All settings made in this menu can be saved to disk..

Measurement Log command (Options Menu)

Use this command to enable or disable the Measurement Log function.
A check mark appears next to the command name when the Log is enabled.
For more information, see Log *(p45)*.

Display command (Options Menu)

Use this command to modify the color, style and width of various components that form the Sweep Graph display.

Dialogue Box Options

Feature

Select the component you want to change.

Note: *Text style and width default to solid and 1 respectively, and cannot be modified.*

Color

Select a new color for the component you select in the Feature box.

Style

Select a new style for the component you select in the Feature box.

Note: *For line widths greater than 1, the style defaults to solid and cannot be modified.*

Width

Select a new width for the component you select in the Feature box.

Sample

This box displays a line drawn using the current color, style and width settings.

Default

Select this button to return all color, style and width settings to the following default values:

Feature	Color	Style	Width
Border	Black	Solid	1
Vertical Grid Major	Grey	Solid	1
Vertical Grid Minor	Grey	Dot	1
Horizontal Grid	Grey	Dot	1
Text	Black	Solid	1
Trace	Blue	Solid	1
Ref. Trace	Cyan	Solid	1
Limit	Light Red	Dash	1
Normal Marker	Light Red	Solid	1
Delta Marker	Light Magenta	Solid	1

Default Paths command (Options Menu)

Use this command to modify the default locations of each type of data file used by FSE-K4.

Dialogue Box Options

Default directory

This field displays the current default directory for the data type you select in the Files of Type box.

Files of Type

Select the type of file whose default directory you want to modify.

Analyzer Setup	Analyzer Setup files.
Result Data	Result Data files.
Limit Line	Limit Line files.

Directories

Select the default directory in which FSE-K4 will store the data type you select in the Files of Type box. The default directory will not actually change until the Set command button is selected.

Note: *To select a directory, double click on the directory name until the open folder icon is shown.*

Drives

Select the default drive on which FSE-K4 will store the data type you select in the Files of Type box. The default directory will not actually change until the Set command button is selected.

Set

Select this button to copy the current drive and directory settings to the Default directory field.

Analyzer command (Options Menu)

Use this command to modify the default Analyzer type, address and start-up conditions.

Note: *At startup, FSE-K4 will check to see if the analyzer it was last used with is present. If not, it checks to see if it is running on an FSE Series Analyzer. It this fails, it checks each GPIB address.*

- If no analyzer is found, FSE-K4 assumes that you will connect an analyzer later, and selects the analyzer type used most recently as the default.
- If FSE-K4 is running on the analyzer, it selects the internal, DDE communications method, which bypasses the GPIB, and sets this analyzer and communications method as the new default.
- Finally, if an analyzer is found at a GPIB address, these are set as the new default.

This command allows you to override these settings when an analyzer is connected to the bus after startup.

Dialogue Box Options

Use DDE

When FSE-K4 is run on the analyzer, this enables control of the analyzer without using the GPIB.

Use GPIB

When FSE-K4 is not run on the analyzer, this enables control of the analyzer using the GPIB.

Address

Select the bus address of the Analyzer you want to work with. If the analyzer is connected and turned on when you start FSE-K4, this value will be set automatically.

Initialize on start-up

Enables initialization of the Analyzer each time FSE-K4 is started. This is equivalent to pressing the PRESET key on the front panel of the Analyzer.

Save Options command (Options Menu)

Use this command to save all Options Menu settings to disk.
Each setting is written to the FSE-K4.INI file, which resides in your Windows directory. Each time you restart FSE-K4, these settings will be used.

Note: *To make temporary changes, simply use the Options Menu commands to alter the settings as required, but do not use the Save Options command. Next time you start FSE-K4 the temporary settings will be replaced with your normal settings.*

Help Menu

The Help Menu offers commands used for starting the FSE-K4 on-line Help and obtaining information on the installed software and on product support services.

Contents command (Help Menu)

Use this command to display the opening screen of Help. From the opening screen, you can jump to various types of reference information.
Once you open Help, you can click the first button on the left in the help window whenever you want to return to the opening screen.

Search for Help on command (Help Menu)

Displays Help's Search dialogue so you can quickly find the information you need.

Obtaining Technical Support command

Gives details on product support services for FSE-K4 available to you from Rohde & Schwarz.

About FSE-K4 command (Help Menu)

Use this command to display the version number of your copy of FSE-K4 for Windows, the copyright notice, Windows mode, available memory, and installed math co-processors.

Control Menu

The Control menu is located at the left end of the title bar in an application window. It comprises the commands used for modifying or closing the active application window and for switching to another application.

To display commands that control the size and position of an application window, click the application Control-menu box or press ALT+SPACEBAR.

Restore command (Control menu)

Use this command to return the active window to its size and position before you chose the Maximize or Minimize command.

Clicking in the upper-right corner of a maximized window is the same as choosing the Restore command.

Shortcuts

Mouse: Double-click the title bar.

Move command (Control menu)

Use this command to display a four-headed arrow so you can move the active window or dialogue box with the arrow keys.

Note: *This command is unavailable if you maximize the window.*

Size command (Control menu)

Use this command to display a four-headed arrow so you can move the active window or dialogue box with the arrow keys.

Note: *This command is unavailable if you maximize the window.*

Minimize command (Control menu)

Use this command to reduce the FSE-K4 window to an icon.

Clicking in the upper-right corner of the window is the same as choosing the Minimize command.

Maximize command (Control menu)

Use this command to enlarge the FSE-K4 window to fill the entire screen.

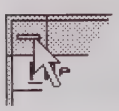
Clicking in the upper-right corner of the window is the same as choosing the Maximize command.

Shortcuts

Mouse: Double-click the title bar

Close command (Control menu)

Use this command to close the FSE-K4 window.
Double-clicking a Control-menu box is the same as choosing the Close command.



Shortcuts

Keys: ALT+F4 closes the FSE-K4 window

Switch To command (Control menu)

Use this command to display a list of all open applications. Use this "Task List" to switch to or close an application on the list.

Shortcut

Keys: CTRL+ESC

Dialogue Box Options

Task List

Select the application you want to switch to or close.

Switch To

Makes the selected application active.

End Task

Closes the selected application.

Cancel

Closes the Task List box.

Cascade

Arranges open applications so they overlap and you can see each title bar.

Note: *This option does not affect applications reduced to icons.*

Tile

Arranges open applications into windows that do not overlap.

Note: *This option does not affect applications reduced to icons.*

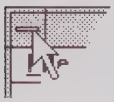
Arrange Icons

Arranges the icons of all minimized applications across the bottom of the screen.

4 Parts of the FSE-K4 Screen

The Application Window for FSE-K4 is divided into the workspace where all measured data is displayed and manipulated, and various control elements and information areas.

FSE-K4 Control menu



Located at the left end of the title bar in an application window.
To display commands that control the size and position of an application window, click the application Control-menu box or press ALT+SPACEBAR.

For more information, see section „Control Menu“ on page 40.

Maximize button

Located at the right end of the title bar when the application is not maximized.
When you click the maximize button, the application window enlarges to fill the screen.

Note: *Maximized windows have no borders.*

Menu bar

Located below the title bar, along the top of the application window, this area contains a list of FSE-K4 commands.
To view all the commands in a menu, do one of the following:
Click the menu name.
Press ALT+*n*, where *n* is the underlined letter in the menu name. For example, press ALT+F to open the File menu.

Minimize button

Located at the right end of the title bar when the application is not minimized.
Clicking the Minimize button is the same as choosing Minimize from the application Control menu: The application window shrinks to an icon.

Restore button

Located at the right end of the title bar when the application window is minimized or maximized.
Clicking the Restore button is the same as choosing Restore from the application Control menu: The application window returns to its previous size.

Status Bar

This is the area across the bottom of the application window below the workspace.
It contains four fields:

Message Field

During long operations this field displays a short message describing the current activity. In certain cases this includes a counter showing the percentage of the task completed so far.

Trace Indicator

Shows the descriptions of the active traces.

Caps Lock Indicator

Shows the current status of the Caps Lock key on the keyboard. When the key is active CAPS appears, otherwise the field is empty.

Num Lock Indicator

Shows the current status of the Num Lock key on the keyboard. When the key is active NUM appears, otherwise the field is empty.

Title Bar

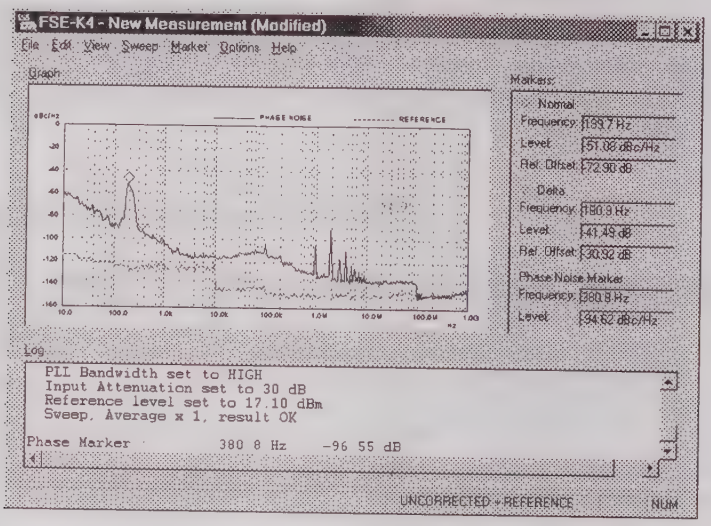
This is the area across the top of the application window between the system menu icon and the minimize, maximize and restore buttons. It displays the application name "FSE-K4" and the name of the current file. FSE-K4 deals with several different file types of varying degrees of importance. The title bar always displays the name of the most important data type currently in use. If the file has been altered in any way since it was loaded this will be indicated by the word **(modified)** appearing to the right of the file name.

The data types are as follows:

Data Type	File Extension	Importance
Limit Line	*.lim	Least
Analyzer Setup	*.set	
Result Data	*.dat	Most

At start-up the default setup for the current default Analyzer is automatically loaded. This has the name "New Setup".

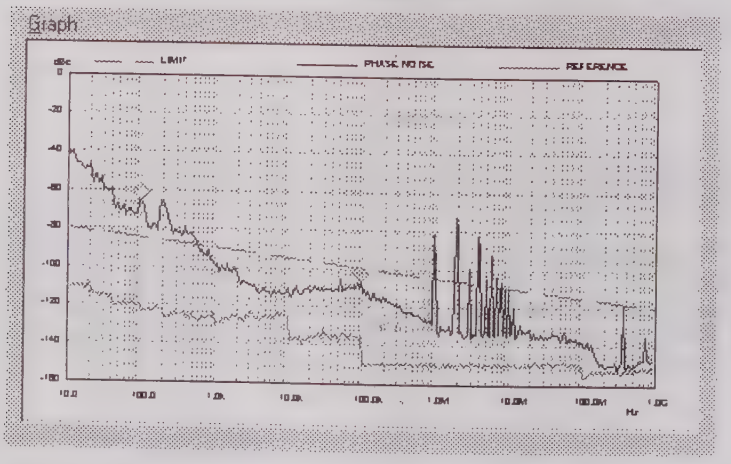
Workspace



This is the area below the menu bar in which all measured data is displayed and manipulated. It contains three areas as follows:

1. Graph *(p45)* area showing the sweep trace as a 2-dimensional graph,
2. Log *(p46)* area displaying information on the last measurement,
3. Markers *(p46)* area showing the current co-ordinates of the active markers.

Graph

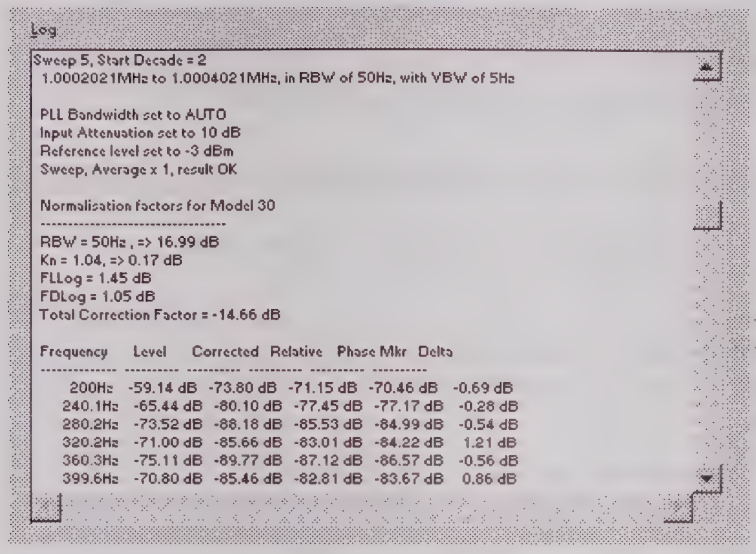


Displayed in the top left of the workspace area, below the menu bar.
Shows sweep trace data in graphical form with, optional limit line, and calculated values of Residual PM and Residual FM. The minimum and maximum values of each axis reflect the frequency offset and level ranges defined in the current Analyzer Setup.

A Markers area *(p46)* may also be displayed, which allows the precise frequency offset and phase noise of each data point to be read from the screen.
To hide or display the Graph, choose Graph from the View menu (ALT, V, G).

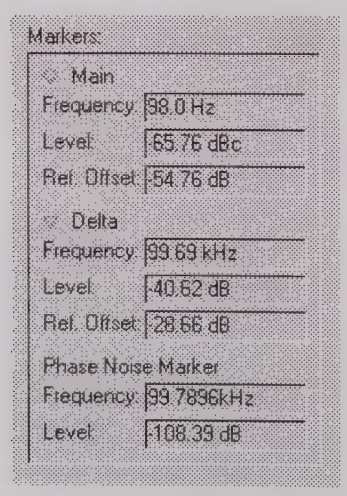
Hint: *The Graph region scales with the application window and always fills the available space within the workspace area. In order to see the most detail, maximize the application and then use the View and Marker menu commands to hide the Log and Normal Marker.*

Log


Log
Sweep 5, Start Decade = 2
1.0002021MHz to 1.0004021MHz, in RBW of 50Hz, with VBW of 5Hz
PLL Bandwidth set to AUTO
Input Attenuation set to 10 dB
Reference level set to -3 dBm
Sweep, Average x 1, result OK
Normalisation factors for Model 30
RBW = 50Hz , => 16.99 dB
Kn = 1.04, => 0.17 dB
FLLog = 1.45 dB
FDLog = 1.05 dB
Total Correction Factor = -14.66 dB
Frequency Level Corrected Relative Phase Mkr Delta
200Hz -59.14 dB -73.80 dB -71.15 dB -70.46 dB -0.69 dB
240.1Hz -65.44 dB -80.10 dB -77.45 dB -77.17 dB -0.28 dB
280.2Hz -73.52 dB -88.18 dB -85.53 dB -84.99 dB -0.54 dB
320.2Hz -71.00 dB -85.66 dB -83.01 dB -84.22 dB 1.21 dB
360.3Hz -75.11 dB -89.77 dB -87.12 dB -86.57 dB -0.56 dB
399.6Hz -70.80 dB -85.46 dB -82.81 dB -83.67 dB 0.86 dB

Displayed at the bottom of the workspace area, above the status bar.
Displays detailed progress and result information for the most recent sweep measurement and any subsequent Measure at Marker operations.
The logging function is only enabled when a tick appears next to the Measurement Log command in the Options menu (ALT, O, L).
When logging is enabled use the Log command in the View menu (ALT, V, L) to hide or display the Log region.
Log information for a sweep measurement is automatically saved and loaded with the Result Data (*.DAT) file. It is stored in a text file (*.TXT) with the same filename as the Result Data file, i.e. if you save Result Data to "MYDATA.DAT" the log information will be saved to "MYDATA.TXT".
See Log Text Files *(p62)* for a description of the Log file content.

Markers



Displayed in the top right of the workspace area, below the menu bar.
Shows the current co-ordinates of the Graph marker(s) and the analyzer's Phase Noise Marker.
To hide or display the Marker region, choose Normal from the Marker menu (ALT, M, N).

Note: *If the Graph is hidden using the Graph command in the View menu, the Marker region is hidden also.*

Normal ◇

This group of fields are always displayed when the Normal marker is enabled.

Frequency

Shows the frequency offset relative to the carrier at the current position.

Level

Shows the absolute phase noise level at the current position

Ref. Offset

This field only appears when the Reference *(p30)* trace is displayed. It shows the difference between the main and reference traces at the current position.

Delta ▽

This group of fields are only displayed when the Delta marker is enabled.

Frequency

Shows the frequency offset relative to the Normal marker at the current position.

Level

Shows the phase noise level offset relative to the Normal marker at the current position

Ref. Offset

This field only appears when the Reference *(p30)* trace is displayed. It shows the difference between the main and reference traces at the current position.

Phase Noise Marker

This group of fields only appears when the Measure at Marker command is used.

Frequency

Shows the frequency offset relative to the carrier at the current Phase Noise Marker position

Level

Shows the absolute phase noise level reported by the Phase Noise Marker at the current Phase Noise Marker position.

5 Keyboard and Mouse

The following chapter gives an overview of the keyboard and mouse functions which can be used for entering characters and numbers, editing text, handling markers and for various other tasks.

Deleting and inserting text

FSE-K4 has numerous shortcut keys you can use to delete or insert text.

Deleting text

To	Press
Delete one character to the left of the insertion point or selected text	BACKSPACE
Delete one character to the right of the insertion point or selected text	DEL
Delete selected text and send it to the Clipboard	CTRL + X or SHIFT + DEL
Reverse the last action (also known as "undo")	CTRL + Z

Inserting text

To	Press
Copy text to the Clipboard	CTRL + C or CTRL + INS
Insert Clipboard contents	CTRL + V or SHIFT + INS

Function keys

You can use the function keys on your keyboard to perform many tasks faster.

F1

To	Press
Get help on the selected command, open dialogue box, or a message	F1

F3

To choose	Press
Sweep Setup *(p25)* from the Edit Menu	F3

F5

To choose	Press
Start *(p32)* from the Sweep Menu	F5

F8

To choose	Press
Stop *(p32)* from the Sweep Menu	F8

F10

To choose	Press
Make the menu bar active	F10

F11

To choose	Press
New *(p21)* from the File Menu	F11

F12

To choose	Press
Save As *(p22)* from the File Menu	F12
Open *(p21)* from the File Menu	CTRL + F12
Save *(p22)* from the File Menu	SHIFT + F12
Print *(p24)* from the File Menu	CTRL + SHIFT + F12

Moving the insertion point in a text entry field

To move the insertion point through a text field:

- Click the new location.

- Do one of the following.

To move	Press
One character to the left	←
One character to the right	→
One word to the left	CTRL + ←
One word to the right	CTRL + →
To the end of a line	END
To the beginning of a line	HOME

Moving the marker

- Position the mouse pointer over the Graph *(p45)* at the desired frequency and click the left mouse pointer. The marker will move to the selected frequency.

1. Press ALT + G to move focus to the Graph.
2. Use the ↑ and ↓ keys for coarse positioning of the marker.
3. Use the ← and → keys to move the marker to the desired frequency.

Re-measuring at the Marker

▸ Do one of the following.

1. Position the mouse pointer over the Graph *(p45)* at the desired frequency.
2. Double-click the left mouse button. If the selected frequency is outside the current analyzer settings, the sub-band containing the frequency will be re-measured. The Analyzer will then position its Phase Noise Marker at the selected frequency and the measured phase noise will be reported in the Markers panel.

Alternatively

1. Position the mouse pointer over the Graph at the desired frequency and click the left mouse button. The marker will move to the selected frequency.
2. Choose the Measure at Marker *(p34)* command from the Marker menu.

1. Press ALT + G to move focus to the Graph.
2. Use the ← and → keys to move the marker to the desired frequency. See Moving the marker *(p50)* for more information.
3. Choose the Measure at Marker *(p34)* command (ALT, M, M) from the Marker menu.

Selecting in a text entry field

▸ Do one of the following:

To select	Do this
Any text	Drag across the text you want to select. You can also select any text by placing the insertion point at one end of the text you want to select, then holding down the SHIFT key, and then clicking the opposite end of the text.
A word	Double-click the word.

▸ Do one of the following:

To extend selection	Press
One character to the left	SHIFT + ←
One character to the right	SHIFT + →
One word to the left	CTRL + SHIFT + ←
One word to the right	CTRL + SHIFT + →
To the end of a line	SHIFT + END
To the beginning of a line	SHIFT + HOME

Using Table Entry Boxes

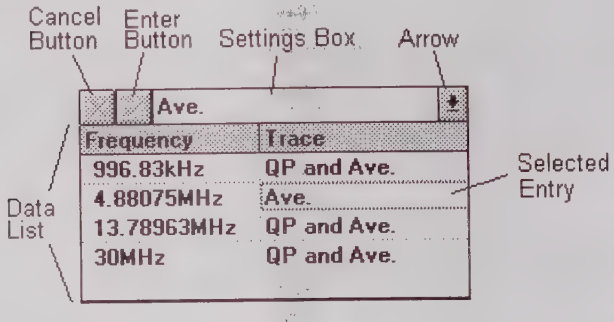
Description

A Table Entry box consists of:

The Settings box

Located at the top of the Table Entry box, this is where you make a change to the selected entry. Simply enter the new value by typing it in the Settings box. Click the Enter button

{bmc ticksel.bmp} to accept the change, or click the Cancel button {bmc crosssel.bmp} to cancel the change.



The Data list

Located at the bottom of the Table Entry box, this list shows the data that you enter into the table and allows you to select an entry to modify.

Table Entry Box Keys

Use these key combinations when the Data list has the focus:

Press	To
Shift+Tab	Switch focus to the command buttons.
Page Down	Move down through the Data list.
Page Up	Move up through the Data list.
↓	Move down through each entry.
↑	Move up through each entry.
→	Move right and down through each entry.
←	Move left and up through each entry.
End	Move to the right hand column.
Home	Move to the left hand column.
Alpha	Move the insertion point to the Settings box and enter a new value.
Tab	Move the insertion point to the Settings box.

For on/off entries simply double click over the entry to switch between the two values.
Use these key combinations when the Settings box has the focus:

Press	To
Ctrl+Z	Undo the last editing action in the current line.
Ctrl+C	Copy the selected text to the Clipboard.
Ctrl+X	Cut the selected text to the Clipboard.
Del	Delete the selected text without placing it on the Clipboard.
Ctrl+V	Paste the Clipboard contents at the insertion point.
Enter	Move the insertion point into the Data list and commit the entry change.
Shift+Tab	Switch focus to the Data list without committing the entry change.
Tab	Move the focus to the Data list and commit the entry change.
Esc	Move the focus to the Data list and cancel the entry change.

6 Command Line Options

You can use the following switches to change the way FSE-K4 behaves when you start the application.

Switch	Argument	Description
/FR	[*drive*][*path*]*filename*	Load the specified result data file (*.dat). If you do not specify a drive or path, FSE-K4 will look in the default Result Data directory specified in the Options Default Paths dialogue box. For example /FRD:\RESULTS\MYDATA.DAT
/FS	[*drive*][*path*]*filename*	Load the specified Analyzer setup file (*.set) For example /FSD:\STANDARD\EN55022.SET
/LI	none	Enables listing of all GPIB operations to a file in the FSE-K4 directory called GPIB.DOC. This is intended for problem solving and should not be used on a regular basis since it reduces system performance.
/SL	none	Forces FSE-K4 to use monochrome bit maps for the tick and cross buttons in Table Entry boxes. This can make these buttons more readable on some display adapters.

The following switches temporarily override the corresponding settings in the Options Analyzer dialogue box.

Switch	Argument	Description
/R	FSEA 20(+B2)(+B4)(+B5) | FSEA 30(+B2) | FSEB 20(+B4)(+B5) | FSEB 30 | FSEM 20(+B4)(+B5) | FSEM 30 | FSEK 20(+B4)(+B5) | FSEK 30 | FSIQ 3(+B2) | FSIQ 7 | FSIQ 26	Specify a different default Analyzer type. For example /RFSEM 30 Note: the text in parentheses is optional and should only be included if the Analyzer is fitted with the corresponding option.
/ID	none	Disable *Initialize on Start-up* function

7 Communication Problems

If the application fails to communicate with the Analyzer, a message box is displayed describing the problem. The following possibilities exist:

Problem	Suggested Action
The computer is not fitted with an GPIB card.	Choose the Cancel button to ignore the problem. The application continues normally but you can only use commands that do not involve the Analyzer.
The interface card is not configured correctly.	Use the configuration software supplied with the interface card to set all parameters to their default condition and then choose Retry. Alternatively choose Cancel to ignore the problem and then re-configure the card at a later time and before attempting to use any Analyzer functions. FSE-K4 is designed to work with the default settings as supplied with the card.
The Analyzer is not connected to the interface card.	Connect the Analyzer and choose Retry. Alternatively choose Cancel to ignore the problem and then connect the Analyzer before attempting to use any Analyzer functions.
The Analyzer is not switched on.	Turn the Analyzer on, wait for it to initialize, and then choose Retry. Alternatively choose Cancel to ignore the problem and then turn on the Analyzer before attempting to use any Analyzer functions.
The Analyzer bus address does not match that specified in the Options Analyzer dialogue box.	Change the Analyzer address to match that set in the Options Analyzer dialogue box and then choose Retry. Alternatively choose Cancel to ignore the problem and then modify the address in the Options Analyzer dialogue box before attempting to use any Analyzer functions.

8 Data Storage Format

With the exception of Log Text Files, FSE-K4 stores all setup and result data in the form of ASCII tab delimited files.
The first line of each file is the long description that you enter in the right hand side of the File Description box in the Save As dialogue box. The remainder consists of EntryValue pairs representing run-time options for the application. Related entries are grouped together in Sections, which start with a section name in square brackets [], and finish with [END].

There are five different types of data file as follows:

Limit Line Files *(p57)*	Contains a Limit Line definition
Analyzer Setup Files *(p58)*	Contains definitions for a Sweep Setup and an optional Limit Line
Result Data Files *(p60)*	Complete list of measured values, definitions for the Sweep Setup used to make the measurement, and an optional Limit Line.
Log Text Files *(p62)*	Complete text of the measurement log generated during a measurement.
FSE-K4.INI *(p64)*	Configuration settings

Conventions Used in Descriptions of Data Storage Format

This section uses the following typographic conventions

keywords	In syntax, normal letters indicate information you must type as shown.
description	In syntax, letters with serifs indicate descriptive information, which you should NOT include.
variable	In syntax, italic letters can indicate placeholders for information you supply.
{ON | OFF}	In syntax, braces and a vertical bar indicate a choice between two or more items. You must choose one of the items unless all of the items also are enclosed in angle brackets.
(option)	In syntax, parentheses indicate optional items. For example 'FSEA 20(+B2)(+B4)(+B5)' means the text string 'FSEA 20' plus any combination of the text strings '+B2', '+B4', and '+B5' including none of them.
TAB	The tab character, ASCII 9.

Limit Line Files

These contain the following groups and entries

Line	[Group] or Entry	Value
1		*Long description, which you enter in the right hand side of File Description box in the Save As dialogue box*
2	[VERSION]	
3	VERSION	*Software version used to write the file, enclosed in single quotes*
4	[END]	
5	[LIMIT]	

Line	[Group] or Entry	Value
6	MAX	*Value of limit parameter in peak vertex*
7	NAME	*Identifier entered in Name box of Limit Line dialogue box, enclosed in single quotes*
8	BANK	0
9	LENGTH	*Number of vertices*
10	VERTEX	0 TAB *Frequency of first vertex* TAB *Limit value of first vertex*
11	VERTEX	1 TAB *Frequency of second vertex* TAB *Limit value of second vertex*
⋮	⋮	⋮
10+(n-1)	VERTEX	*n-1* TAB *Frequency of last vertex* TAB *Limit value of last vertex.* Where n = the number of vertices.
10+n	[END]	

Analyzer Setup Files

These contain the following groups and entries

Line	[Group] or Entry	Value
1		*Long description, which you enter in the right hand side of File Description box in the Save As dialogue box*
2	[VERSION]	
3	VERSION	*Software version used to write the file, enclosed in single quotes*
4	[END]	
5	[RX SETUP]	
6	RX TYPE	{ 'FSEA 20(+B2)(+B4)(+B5)' | 'FSEA 30'(+B2)' | 'FSEB 20(+B4)(+B5)' | 'FSEB 30' | 'FSEM 20(+B4)(+B5)' | 'FSEM 30' | 'FSEK 20(+B4)(+B5)' | 'FSEK 30' | 'FSIQ 3(+B2)' | 'FSIQ 7' | 'FSIQ 26' }
7	GRID START FREQ	*Graph x-axis start frequency in hertz*
8	GRID STOP FREQ	*Graph x-axis stop frequency in hertz*
9	GRID MINLEVEL	*Graph y-axis minimum in dBc/ Hz*
10	GRID MAXLEVEL	*Graph y-axis maximum in dBc/ Hz*
11	SWEEP CENTER FREQ	*Signal frequency in hertz*
12	SWEEP FREQ TOLERANCE	*Signal tolerance frequency in hertz*
13	SWEEP LEVEL TOLERANCE	*Signal tolerance level in dB*
14	SWEEP MIN FREQ OFFSET	*Minimum offset frequency to be measured in hertz*
15	SWEEP MAX FREQ OFFSET	*Maximum offset frequency to be measured in hertz*
16	SWEEP DISPLAY REF	0
17	SWEEP REF LEVEL	*Graph y-axis maximum in dBc/ Hz*
18	SWEEP LEVEL RANGE	*Graph y-axis range in dB*
19	SWEEP LEVEL OFFSET	*Offset value to be added to all measured values in dB*
20	SWEEP COUPLING RATIO	{ 10 | 1 | 0.1 } where 10 means 'RBW = 10 x VBW', 1 means 'RBW = VBW', and 0.1 means '10 x RBW = VBW'
21	SWEEP SMOOTHING WINDOW	*Smoothing window width in number-of-samples*

Line	[Group] or Entry	Value
22	SWEEP VERIFY CENTER	{ 1 | 0 } where 1 means *"Verify Signal Frequency and Level"*, and 0 means *"Do not Verify Signal Frequency and Level"*
23	REPORT HEADING	*User report text, enclosed in single quotes*
24	REPORT MEASUREMENT TYPE	*User report text, enclosed in single quotes*
25	REPORT EUT NAME	*User report text, enclosed in single quotes*
26	REPORT MANUFACTURER	*User report text, enclosed in single quotes*
27	REPORT CONDITIONS	*User report text, enclosed in single quotes*
28	REPORT OPERATOR	*User report text, enclosed in single quotes*
29	REPORT TEST SPEC	*User report text, enclosed in single quotes*
30	REPORT COMMENT 1	*User report text, enclosed in single quotes*
31	REPORT COMMENT 2	*User report text, enclosed in single quotes*
32	REPORT TITLES	{ 1 | 0 } where 1 means 'Include user report text', and 0 means 'Exclude user report text'
33	REPORT DATE	{ 1 | 0 } where 1 means 'Include measurement complete date', and 0 means 'Exclude measurement complete date'
34	REPORT SWEEP	{ 1 | 0 } where 1 means 'Include setup information', and 0 means 'Exclude setup information'
35	LIMIT UPPER NAME	*Identifier entered in Name box of Limit Line dialogue box, enclosed in single quotes*
36	LIMIT UPPER DESCRIPTION	*Long description, of limit line file, which you enter in the right hand side of File Description box in the Save As dialogue box, enclosed in single quotes*
37	LIMIT UPPER BANK	0
38	SUBBAND RBW	1 1 *RBW for decade 1, sub-band 1*
39	SUBBAND RBW	1 2 *RBW for decade 1, sub-band 2*
40	SUBBAND RBW	1 3 *RBW for decade 1, sub-band 3*
41	SUBBAND RBW	2 1 *RBW for decade 2, sub-band 1*
42	SUBBAND RBW	2 2 *RBW for decade 2, sub-band 2*
43	SUBBAND RBW	2 3 *RBW for decade 2, sub-band 3*
44	SUBBAND RBW	3 1 *RBW for decade 3, sub-band 1*
45	SUBBAND RBW	4 1 *RBW for decade 4, sub-band 1*
46	SUBBAND RBW	4 2 *RBW for decade 4, sub-band 2*
47	SUBBAND RBW	5 1 *RBW for decade 5, sub-band 1*
48	SUBBAND RBW	6 1 *RBW for decade 6, sub-band 1*
49	SUBBAND RBW	7 1 *RBW for decade 7, sub-band 1*
50	SUBBAND RBW	8 1 *RBW for decade 8, sub-band 1*
51	SUBBAND RBW	9 1 *RBW for decade 9, sub-band 1*
52	SUBBAND SWEEPS	1 1 *Sweep count for dec. 1, sub-band 1*
53	SUBBAND SWEEPS	1 2 *Sweep count for dec. 1, sub-band 2*
54	SUBBAND SWEEPS	1 3 *Sweep count for dec. 1, sub-band 3*
55	SUBBAND SWEEPS	2 1 *Sweep count for dec. 2, sub-band 1*
56	SUBBAND SWEEPS	2 2 *Sweep count for dec. 2, sub-band 2*
57	SUBBAND SWEEPS	2 3 *Sweep count for dec. 2, sub-band 3*
58	SUBBAND SWEEPS	3 1 *Sweep count for dec. 3, sub-band 1*

Line	[Group] or Entry	Value		
59	SUBBAND SWEEPS	4	1	*Sweep count for dec. 4, sub-band 1*
60	SUBBAND SWEEPS	4	2	*Sweep count for dec. 4, sub-band 2*
61	SUBBAND SWEEPS	5	1	*Sweep count for dec. 5, sub-band 1*
62	SUBBAND SWEEPS	6	1	*Sweep count for dec. 6, sub-band 1*
63	SUBBAND SWEEPS	7	1	*Sweep count for dec. 7, sub-band 1*
64	SUBBAND SWEEPS	8	1	*Sweep count for dec. 8, sub-band 1*
65	SUBBAND SWEEPS	9	1	*Sweep count for dec. 9, sub-band 1*
66	SUBBAND FFT	1	1	{ 0 | 1 } where 0 means 'do not use FFT filter', and 1 means 'do use FFT filter' for decade 1, sub-band 1
67	SUBBAND FFT	1	2	{ 0 | 1 } for decade 1, sub-band 2
68	SUBBAND FFT	1	3	{ 0 | 1 } for decade 1, sub-band 3
69	SUBBAND FFT	2	1	{ 0 | 1 } for decade 2, sub-band 1
70	SUBBAND FFT	2	2	{ 0 | 1 } for decade 2, sub-band 2
71	SUBBAND FFT	2	3	{ 0 | 1 } for decade 2, sub-band 3
72	SUBBAND FFT	3	1	{ 0 | 1 } for decade 3, sub-band 1
73	SUBBAND FFT	4	1	{ 0 | 1 } for decade 4, sub-band 1
74	SUBBAND FFT	4	2	{ 0 | 1 } for decade 4, sub-band 2
75	SUBBAND FFT	5	1	{ 0 | 1 } for decade 5, sub-band 1
76	SUBBAND FFT	6	1	{ 0 | 1 } for decade 6, sub-band 1
77	SUBBAND FFT	7	1	{ 0 | 1 } for decade 7, sub-band 1
78	SUBBAND FFT	8	1	{ 0 | 1 } for decade 8, sub-band 1
79	SUBBAND FFT	9	1	{ 0 | 1 } for decade 9, sub-band 1
80	[END]			
81	[LIMIT] Same as [LIMIT] section in Limit Line Files *(p57)*.			
86+ n	[END]			

Result Data Files

These contain the following groups and entries:

Line	[Group] or Entry	Value
1		*Long description, which you enter in the right hand side of File Description box in the Save As dialogue box*
2	[VERSION]	
3	VERSION	*Software version used to write the file, enclosed in single quotes*
4	[END]	
5	[REPORT]	
6	VIEW MODE	*Bitmap value indicating display mode of Graph* where bit 0 = Uncorrected trace, bit 1 = Corrected trace, bit 2 = Reference trace, bit 3 = Residual PM, bit 4 = Residual FM. If the bit is set, the feature will be displayed.

Line	[Group] or Entry	Value
7	MARKER MODE	*Bitmap value indicating marker display mode* where bit 0 = Delta Marker, bit 1 = Normal Marker. If the bit is set, the Marker will be displayed
8	MARKER NORMAL	*Frequency of Normal Marker in hertz.*
9	MARKER DELTA	*Frequency of Delta Marker in hertz.*
10	DATE STAMP	*Date and time at which measurement was completed, enclosed in single quotes*
11	SETUP NAME	*File name, of analyzer setup file, which you enter in the left hand side of File Description box in the Save As dialogue box, enclosed in single quotes*
12	SETUP DESCRIPTION	*Long description, of analyzer setup file, which you enter in the right hand side of File Description box in the Save As dialogue box, enclosed in single quotes*
13	[END]	
14	[RX SETUP] Same as [RX SETUP] section Analyzer Setup Files *(p58).*	
89	[END]	
90	[LIMIT] Same as [LIMIT] section in Limit Line Files *(p57).*	
95+n	[END]	
96	[SWEEP DATA]	
97	START	*Minimum offset frequency measured in hertz*
98	STOP	*Maximum offset frequency measured in hertz*
99	TOTAL	*Number of measurement points expected.* This is calculated as: 1 + 499 x the number of sub-bands measured
100	MAX	*Number of measurement points that will be saved.* If TOTAL > 30000 then this value is 30000, otherwise it is equal to TOTAL.
101	NEXT	*Index that will be used for the next measurement point received - 1.* If the measurement was completed this value will be equal to MAX.
102	LAST	*Index that was used for the last measurement point received.* If the measurement was completed this value will be equal to MAX.
103	FACTOR	*Conversion factor from expected measurement point number to saved point index.* If TOTAL is equal to MAX this will be -1, otherwise it will be: -1 x (MAX/TOTAL)
104	LOGSCALE	0
105	SIGNAL FREQUENCY	Signal frequency measured by the *Verify Signal Frequency and Level* function in hertz.
106	SIGNAL LEVEL	Signal level measured by the *Verify Signal Frequency and Level* function in hertz.
107	VERTEX	0 TAB *Frequency of first vertex* TAB *Level value of first vertex* TAB 0 TAB 1
108	VERTEX	1 TAB *Frequency of second vertex* TAB *Level value of second vertex* TAB 0 TAB 1
⋮	⋮	⋮
107+(n-1)	VERTEX	1 TAB *Frequency of last vertex* TAB *Level value of last vertex* TAB 0 TAB 1. Where n = the number of saved points
107+n	[END]	
107+(n+1)	[SWEEP DATA] Same layout as preceding [SWEEP DATA] section.	This section will only exist if the result data file includes a reference trace. When this section is included, the preceding [SWEEP DATA] section contains the reference trace data, and this section contains the uncorrected

Line	[Group] or Entry	Value
		trace data. The corrected trace is not stored since it can be calculated from the uncorrected and reference traces. When this section is not included, the preceding section contains the uncorrected trace data.
209+(2 x n)	[END]	

Log Text Files

Each time a new sweep measurement is started, the log is cleared. FSE-K4 then tries to initialize the analyzer and will log the result, for example:

```
Initialization
==============

Analyzer type FSEB 30+B2+B4+B5 initialized successfully.
```

If the Carrier Search function is enabled, its results will appear next. The analyzer sweeps a span of twice the Frequency Tolerance, centered on the Signal Frequency specified in the Sweep Setup dialogue. If the peak exceeds the reference level, the reference level is increased by 10dB and the sweep repeated. The peak is then accurately measured using the frequency counter and marker. For example:

```
Carrier search starting
=======================

  Center 100 MHz, Span 2 kHz
  RBW 2 kHz, Reference level -15.00 dBm
  Sweep, Max Hold x 1, result OK
  Peak found at 50.0000661 MHz, 2.94 dBm

  Sweep, ClearWrite x 1, result OK

Carrier found at 149.9999939 MHz, 2.94 dBm
```

If no Signal is found or if the Signal is outside the specified tolerances, the measurement will be aborted. The Reference Level and any Level Offset to be used during the Phase Noise sweep are then logged, for example:

```
Ref. Level will be set to 2.94 dBm for offsets less than 10 kHz.
Ref. Level will be set to -17.06 dBm for offsets greater than 10 kHz

Level Offset is 0.00 dB
```

Input attenuation is normally calculated to obtain a signal level of up to +5dBm at the mixer input for offsets greater than 10 kHz. However since the frequency response of the front end is not guaranteed to be flat, it is necessary to check whether any additional attenuation will be required for offsets from 10 kHz to 100 MHz. Above this, the carrier is well outside the edges of the resolution bandwidth filter and not additional attenuation is required.

A check is made to see if the RF Overload warning is activated with the calculated input attenuation. If it is activated, the attenuation is increased in 10dB steps until the overload is removed.

```
RF Overload Check starting
==========================

  Input Attenuation set to 0 dB
  Sweep, Average x 1, result *** RF Over Range ***
  Input Attenuation set to 10 dB
  Sweep, Average x 1, result OK
```

```
Attenuation will be offset by 10 dB, in the range 10 kHz to 100 MHz
```

The Phase Noise measurement then starts. The overall sweep is divided into one or more sub-sweeps depending on the specified start and stop offsets. For each sub-sweep the following information is logged:

Start Decade Number	Sub-sweep within decade
Absolute Start Frequency	Absolute Stop Frequency
Resolution Bandwidth	Video Bandwidth
Main PLL Bandwidth	Input Attenuation
Reference level	Normalization Factors

In addition the analyzer's Phase Noise Marker is used to measure at six points equally spaced across the sub-band and the results are listed along with the results from the sub-band and the computed difference. For example:

```
Sweep 1, Start Decade = 3, Sub-band = 1

  Offsets 1kHz to 10kHz relative to 149.9999939MHz
  RBW set to 200Hz
  PLL Bandwidth set to HIGH, FFT Filter is ON
  Input Attenuation set to 20 dB
  Reference level set to 2.90 dBm
  Sweep, Average x 1, result OK

  Normalization factors for Model 7
  ---------------------------------
  RBW = 200Hz , => 23.01 dB
  Kn = 1.06, => 0.25 dB
  FLLog = 1.45 dB
  FDLog = 1.05 dB
  Total Correction Factor = -20.76 dB

  Frequency   Level       Corrected   Relative    Phase Mkr   Delta
  ----------  ----------  ----------  ----------  ----------  ----------
        1kHz    -80.89 dB  -101.65 dB  -104.59 dB  -105.79 dB     1.20 dB
   2.8036kHz    -92.96 dB  -113.72 dB  -116.66 dB  -115.43 dB    -1.23 dB
   4.6072kHz    -86.93 dB  -107.69 dB  -110.63 dB  -115.99 dB     5.36 dB
   6.4108kHz    -92.96 dB  -113.72 dB  -116.66 dB  -116.23 dB    -0.43 dB
   8.2144kHz    -92.96 dB  -113.72 dB  -116.66 dB  -116.59 dB    -0.07 dB
       10kHz    -86.93 dB  -107.69 dB  -110.63 dB  -111.10 dB     0.47 dB
```

Once the sweep is complete the following message is logged:

```
Phase Noise measurement complete
================================
```

FSE-K4.INI

These contain the following groups and entries

Line	[Group] or Entry	Value
1	[VERSION]	
2	VERSION	*Software version used to write the file, enclosed in single quotes*
3	[END]	
4	[SETUP]	
5	ANALYZER	{ 'FSEA 20(+B2)(+B4)(+B5)' I 'FSEA 30'(+B2)' I 'FSEB 20(+B4)(+B5)' I 'FSEB 30' I 'FSEM 20(+B4)(+B5)' I 'FSEM 30' I 'FSEK 20(+B4)(+B5)' I 'FSEK 30' I 'FSIQ 3(+B2)' I 'FSIQ 7' I 'FSIQ 26' }
6	METHOD	{ 0 I 1 } where 0 means 'use GPIB', and 1 means 'use DDE'
7	INITIALIZE	{ 0 I 1 } where 0 means 'do not initialize on start-up', and 1 means 'do initialize on start-up'.
8	ADDRESS	{ 0 I 1 I ... I 31 }
9	DEFAULT PATH	0 *Fully qualified path for Analyzer Setup files*
10	DEFAULT PATH	1 *Fully qualified path for Result Data files*
11	DEFAULT PATH	2 *Fully qualified path for Limit Line files*
12	GRAPHIC FORMAT	0 *Bitmap value indicating color, style, and line width used to draw Graph border*
		Where bits 0 to 3 specify the color, bits 4 to 7 specify the Style, and bits 8 to 11 specify the line width.
13	GRAPHIC FORMAT	1 *Bitmap value indicating color, style, and line width used to draw Graph Vertical Grid*
14	GRAPHIC FORMAT	2 *Bitmap value indicating color, style, and line width used to draw Graph Horizontal Grid*
15	GRAPHIC FORMAT	3 *Bitmap value indicating color, style, and line width used to draw Graph Text*
16	GRAPHIC FORMAT	4 *Bitmap value indicating color, style, and line width used to draw Graph Trace*
17	GRAPHIC FORMAT	5 *Bitmap value indicating color, style, and line width used to draw Graph Ref. Trace*
18	GRAPHIC FORMAT	6 *Bitmap value indicating color, style, and line width used to draw Graph Limit*
19	GRAPHIC FORMAT	7 *Bitmap value indicating color, style, and line width used to draw Graph Normal Marker*
20	GRAPHIC FORMAT	8 *Bitmap value indicating color, style, and line width used to draw Graph Delta Marker*
21	DDE GRAPH	0
22	DDE SETUP	0
23	DDE TEXT	0
24	DDE START	0
25	DDE STOP	0
26	HELPFILE	*Name of help file*

Line	[Group] or Entry	Value
27	TMO NORMAL	{ 0 | 1 | ... | 17 } Sets the normal GPIB timeout period. Default value is 12. 0 means disabled - no timeout 1 10 µs 2 30 µs 3 100 µs 4 300 µs 5 1 ms 6 3 ms 7 10 ms 8 30 ms 9 100 ms 10 300 ms 11 1 s 12 3 s 13 10 s 14 30 s 15 100 s 16 300 s 17 1000 s
28	TMO SPOLL	{ 0 | 1 | ... | 17 } Sets the GPIB timeout period used during serial poll operations. Default value is 13
29	TMO DISPLAY	{ 0 | 1 | ... | 17 } Sets the GPIB timeout period used during display update operations. Default value is 13
30	TMO INIT	{ 0 | 1 | ... | 17 } Sets the GPIB timeout period used during initialization operations. Default value is 12
31	LOG SWEEP	{ 0 | -1 } where 0 means 'disable Measurement Log', and -1 means 'enable measurement log'
32	[END]	

9 Decision and Error Messages

The following table contains an alphabetical list of all decision and error messages that can be issued by FSE-K4. An explanation, possible options and/or steps for error elimination are given for each message.

Message	Explanation ➢ Error elimination
Analyzer failed identification test at GPIB address (number)	FSE-K4 tried to identify the Analyzer type using the specified GPIB address, but there was no response. Either there is another device using the same address, or the Analyzer has the wrong bus address, or it is not connected to the GPIB, or it is not turned on. **To fix the problem and try again** ➢ Check that the Analyzer is switched on, connected to the GPIB, and set to the specified bus address. Also verify that there are no other devices using the same address. Then choose the Retry button. **To abort the Analyzer operation** ➢ Choose the Cancel button.
Analyzer frequency range exceeded	The frequency range of the specified files exceeds the capabilities of the specified Analyzer. It will not be possible to make a sweep measurement. **To correct this problem do one of the following:** ➢ Modify the frequency range of the specified files before making a measurement. ➢ Use a different Analyzer.
Analyzer not found at GPIB address (number)	FSE-K4 tried to control the Analyzer using the specified GPIB address, but there was no response. Either the Analyzer has the wrong bus address, or it is not connected to the GPIB, or it is not turned on. **To fix the problem and try again** ➢ Check that the Analyzer is switched on, connected to the GPIB, and set to the specified bus address. Then choose the Retry button. **To abort the Analyzer operation** ➢ Choose the Cancel button.
Analyzer not responding	FSE-K4 tried to control the Analyzer but there was no response. Either the Analyzer is not connected to the GPIB, or it is not turned on. **To fix the problem and try again** ➢ Check that the Analyzer is switched on, and connected to the GPIB. Then choose the Retry button. **To abort the Analyzer operation** ➢ Choose the Cancel button.
Analyzer type at GPIB address (number) is not supported	FSE-K4 found an unsupported device type at the specified GPIB address. **To fix the problem and try again** ➢ Choose the OK button to abort this Analyzer operation. Replace the Analyzer with one of the following: FSEA 20(+B2)(+B4)(+B5) I FSEA 30(+B2) I FSEB 20(+B4)(+B5) I FSEB 30 I FSEM 20(+B4)(+B5) I FSEM 30 I FSEK 20(+B4)(+B5) I FSEK 30 I FSIQ 3(+B2) I FSIQ 7 I FSIQ 26, where the text in parentheses is optional and should only be included if the corresponding option is fitted to your Analyzer. Then try again.
Analyzer type does not match setup	FSE-K4 found that the active Analyzer is of a different type to that specified in the Sweep Setup *(p25)*. **To correct this error do one of the following:** ➢ Change the Sweep Setup to select the correct Analyzer type. ➢ Change the Analyzer to match that specified in the Sweep Setup.

Message	Explanation ➢ Error elimination
Changes to Analyzer setup will invalidate results	One or more of the changes you have made affect the way in which the Sweep measurement is made. Thus the measured data currently stored in memory has become invalid and will be erased. **To continue with the new settings and erase existing results** ➢ Choose the OK button. **To undo the changes and retain the existing results** 1. Choose the Cancel button. 2. Exit the editor by choosing the Cancel button.
DDE Link driver software missing	FSE-K4 was unable to find the driver software for the DDE Link. The driver files are called RSIB.DLL and RSDDE.DLL, and should have been installed in your C:\WINDOWS\SYSTEM directory, or equivalent. **To correct this error** ➢ Copy the files from the C:\RSIB directory on the FSE hard disk to the C:\WINDOWS\SYSTEM directory. Then re-start Windows and FSE-K4. ➢ If the C:\RSIB directory is missing, contact your Rohde & Schwarz representative and ask for a firmware upgrade. Once this has been installed, re-install the FSE-K4 software, by following the instructions on the disk label, and re-start FSE-K4.
ERROR	An error condition has occurred. Please make a note of the error message and your actions leading up to it's appearance and report them to Rohde & Schwarz Services Ltd. **To continue** ➢ Choose the OK button to continue the application.
File already exists	While saving a file, you typed the name of an existing file. **To replace the existing file with the active file** ➢ Choose the Yes button. **To retain the existing file** 1. Choose the No button. 2. Type a different name for the active file.
File does not exist	You tried to open a file that does not exist. **To correct this error do one of the following:** ➢ Make sure you typed the correct path and filename. ➢ Type the name of a file that exists. ➢ If a list is available, select a filename.
GPIB address not specified	There is no GPIB address defined for the specified Analyzer type so FSE-K4 is unable to establish communication. **To correct this error** ➢ Assign a valid bus address to the specified Analyzer type using the Analyzer *(p37)* command in the Options menu, then re-try. complete.
GPIB card missing	FSE-K4 was unable to find a GPIB card installed in this computer and will not be able to control an Analyzer. **To correct this error** 1. Install and configure a supported interface card. 2. Re-run FSE-K4.

Message	Explanation ➢ Error elimination
GPIB driver did not recognize the name	FSE-K4 was unable to communicate with the GPIB. **To correct this error** 1. Run the configuration software supplied with the interface card and set all parameters to their default condition. 2. Choose Retry to try again. **To continue without GPIB capability** ➢ Choose Cancel.
GPIB driver software missing or out-of-date	FSE-K4 was unable to find the driver software for your GPIB, or the driver does not support the required functionality. The driver file is called GPIB.DLL and should have been installed in your C:\WINDOWS\SYSTEM directory, or equivalent. **To correct this error** ➢ If the driver is missing: re-install it, from the disks supplied with your GPIB card, according to the manufacturers instructions. Then re-start Windows and FSE-K4. ➢ If the driver is out-of-date: contact your GPIB card supplier and ask for the latest release of driver software for your card and operating system. Then install it according to the manufacturers instructions, and re-start Windows and FSE-K4.
Incorrect entries	You specified one or more values that are outside the capabilities of the specified Analyzer type. **To fix the problem and try again** ➢ Correct the specified parameters. ➢ Choose the OK command button. **Note:** *Refer to the documentation supplied with your Analyzer for more information concerning the range of values that may be entered.*
Limit definition error	A limit line definition must contain a name, and at least two samples. **To fix the problem and try again** 1. Correct the specified parameters. 2. Choose the OK command button.
MEASUREMENT ABORTED - Analyzer firmware does not support FFT Filter control via GPIB	You enabled FFT Filters for one or more sub-bands, however the version of firmware installed on your analyzer does not support the control of FFT Filters via the GPIB. Please contact your Rohde & Schwarz representative and ask for a firmware upgrade. Once this has been installed, FSE-K4 will allowing these settings to be used.
MEASUREMENT ABORTED - Carrier Frequency is outside Signal Frequency Tolerance range	FSE-K4 has found a Signal Carrier which is either lower than the Signal Frequency - Frequency Tolerance, or greater than the Signal Frequency + Frequency Tolerance. **To fix this problem do one of the following** ➢ Increase the Frequency Tolerance range in the Sweep Setup box. ➢ Modify the Signal Frequency setting in the Sweep Setup box. ➢ Adjust the signal generator to produce the desired output frequency.
MEASUREMENT ABORTED - Max. Peak Level is outside Signal Level Tolerance range	FSE-K4 has found a Signal Carrier which is lower than the Signal Level - Level Tolerance. **To fix this problem do one of the following** ➢ Increase the Level Tolerance range in the Sweep Setup box. ➢ Modify the Signal Level setting in the Sweep Setup box. ➢ Adjust the signal generator to produce the desired output level.

Message	Explanation ➢ Error elimination
MEASUREMENT ABORTED - No Signals found within Signal Frequency Tolerance range	FSE-K4 was unable to find any Signal Carrier. **To fix this problem and try again** 1. Check that the signal generator is producing an output at the correct frequency and level. 2. Check that the signal generator is connected to the Analyzer's RF INPUT. 3. Check that the correct Signal Frequency and Level have been specified in the Sweep Setup box. 4. Choose Start from the Sweep menu, to start a new measurement.
MEASUREMENT ABORTED - Operator command	This message simply confirms that FSE-K4 has responded to the Sweep menu's Stop command.
MEASUREMENT ABORTED - Sweep did not complete within expected time period	The sweep took longer than expected or did not start correctly. This is usually caused by a firmware problem within the Analyzer. **To fix this problem and try again** 1. Turn the analyzer off, and then back on. 2. Wait until the analyzer has initialized, and then try making the measurement again.
MEASUREMENT ABORTED - Sweep range exceeds analyzer maximum stop frequency	The Signal Frequency + Maximum Offset is greater than the maximum frequency that can be measured by the Analyzer. **To fix this problem and try again** 1. Reduce the Maximum Offset in the Sweep Setup box. 2. Choose Start from the Sweep menu, to start a new measurement.
Possible incorrect entries	You specified one or more values that may be outside the capabilities of the specified Analyzer type. Some Analyzers are supplied with an extended frequency range. However it is not possible to determine the upper frequency limit from the model number or installed options. **To try measuring with the programmed values** 1. Choose the OK command button. 2. Try making a measurement by choosing Start from the Sweep menu. If the programmed values exceed the Analyzer's frequency range, the measurement will be aborted. **To modify the programmed values and try again** 1. Choose the Cancel command button in this message box. 2. Correct the specified parameters. 3. Choose the OK command button in the Sweep Setup box. **Note:** *Refer to the documentation supplied with your Analyzer for more information concerning the range of values that may be entered.*
Printer not selected	The Print Setup dialogue was unable to initialize the selected printer. Some drivers such as the HP Plotter cannot be selected from FSE-K4. **To correct this error** ➢ Use the Printer Setup command in Print Manager's Options menu to select and configure the required printer driver before printing from FSE-K4.
Reference trace is not compatible with new setup	FSE-K4 requires that the main and reference traces must contain the same frequency axis settings. **To make reference measurements with the new setup** 1. Make a Sweep measurement with the reference signal only. 2. Choose the Trace To Reference command from the Sweep menu to copy the new reference trace into the reference buffer.

Message	Explanation ➢ Error elimination
Save changes to (file type) (filename)?	You quit FSE-K4 or closed a file without saving changes you made to a file. **To save the changes** ➢ Choose the Yes button. **To discard the changes** ➢ Choose the No button. **To continue without quitting FSE-K4 or saving the changes** ➢ Choose the Cancel button.
Save option menu changes?	You quit FSE-K4 without saving changes you made in the options menu. Option menu settings are stored in the FSE-K4.INI file, which can be found in the main Windows directory. **To save the changes** ➢ Choose the Yes button. **To discard the changes** ➢ Choose the No button.
Sorry, no help available for this subject	➢ See, "Obtaining Technical Support" in the Help menu.

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